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THE MANAGEMENT OF OUTBREAKS OF SMALLPOX, DIPHTHERIA AND SCARLET FEVER.

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I have been assigned the duty of addressing you upon the subject of "The Management of Outbreaks of Smallpox, Diphtheria and Scarlet Fever" from the standpoint of the municipal, local and rural health officer, a subject full of importance and pregnant with the most vital interests of the community in which you live.

SMALLPOX.

Without further preliminaries I would beg to enter at once upon the subject of smallpox, and in considering its management I beg to consider not only the management of epidemics when they have once made their appearance, but the prophylaxis or prevention of such outbreaks.

Prevention. In all communicable diseases there are various means at our disposal for the control and prevention of their spread. Such certainly is the case with smallpox; but I think it admits of no argument that, were we limited to one method for the prevention of the spread of smallpox, that method would be vaccination.

Into the subject of vaccination it is hardly necessary to go before an audience of this character. What the nature of vaccinia is—whether vaccinia is smallpox in the heifer—may be subjects full of interest, but I do not consider that their discussion, however important, properly belongs to an occasion like this. Much prejudice in the past has existed against vaccination, which might *possibly* have been justified in the days of arm to arm vaccination or vaccination from the scab. I can conceive that it is possible that certain constitutional diseases, viz., tuberculosis, or syphilis, might be conveyed by these processes; but, practiced as vaccination is to-day, with bovine lymph, and that lymph largely purified of extraneous organisms and contaminations by the process of glycerination, such untoward results are now of infrequent occurrence, and it is high time in this third year of the twentieth century that the prejudices against this most valuable prophylactic should disappear with the advance of education and intelligence. Of course it is essential that vaccination should be carefully performed. The arm—or leg, in the case of females—upon which vaccination is practiced should be cleansed by soap and water, followed by alcohol. The scarification should not be large; a spot one-eighth of an inch in diameter is sufficient. The vaccine should be glycerinized, and care should be taken to prevent its contamination. As soon as the lymph has dried some light protective dressing should be employed to prevent contamination of the area by pus or-

ganisms, either rubbed in by the fingers or the dress from the surrounding area.

Having placed vaccination thus in the first place of importance for the prevention of smallpox, it might be well asked, What measure takes the next place in importance in the prevention of this disease? I answer after mature deliberation and consideration, and hope that it will meet with your approbation, that early diagnosis in my opinion easily takes the place of next importance.

Diagnosis. Smallpox may be mistaken for several other conditions, viz., measles, scarlet fever, chicken-pox, syphilis, or impetigo contagiosa.

A few words as to the differential diagnosis of these maladies will not be out of place.

In *measles* the period of incubation is a little longer than in smallpox (about fourteen days). The stage of invasion resembles an ordinary cold attended with shivering, not often with definite chills, sneezing, injection of the eyes, running of the nose and a more or less severe cough. The eruption makes its appearance about the fourth or fifth day, and the condition of the patient is not materially improved with the appearance of the eruption. By the sixth day the eruption is well developed and gradually fades, though coming out in successive crops. There is no secondary fever with the appearance of the eruption.

In *scarlet fever* the incubation is much shorter, ranging probably as high as seven days—about four days on an average—and the period of invasion is short and attended with high temperature and more or less sore throat, generally a very considerable sore throat. The eruption appears on the second day, and is in the form of a bright red scarlet rash, in which there are spots of more or less deep mottling, giving a particularly red appearance with marbled streakings. The tongue has a strawberry or raspberry appearance, owing to the projection of the papillæ upon the tongue. Albuminuria is a frequent symptom of scarlet fever.

Chicken-pox or *varicella* might be called strictly a disease of children, though it sometimes occurs in adults. The period of incubation is rather long. The initial symptoms are somewhat mild and frequently attract little attention, though there may be fever, vomiting, and pain in the back and limbs. The eruption appears within the first twenty-four hours, being first papules, which in a few hours change to pustules filled with a gray though generally turbid fluid. In three or four days the eruption dries up and forms scales, which fall off, and the scarring if any is very superficial. It is to be noted that the scabs of chicken-pox are usually bloody in character. It is possible that varioloid may be mistaken for chicken-pox.

Impetigo contagiosa in outward appearance approaches nearer to chicken-pox than smallpox. The eruption is without constitutional symptoms and occurs in groups or patches. The patches coalesce, and as dessication takes place large crusted patches are formed.

Syphilis in some of its protean aspects resembles smallpox. In this disease we must be guided by the history of the case, which is the strongest

point of differentiation, though the absence or very slight character of the fever and other constitutional symptoms aid us in making a differential diagnosis.

I pass over typhus fever, glanders, the first stages of typhoid fever and other diseases without more than mentioning them, and make no attempt to draw a strict differential diagnosis. A brief review now of the symptoms of smallpox may be of interest.

Smallpox may appear in any form from the mild varioloid—which is smallpox modified by vaccination—up to the hemorrhagic form. The forms as usually described are variola vera or true smallpox, the discrete form, the confluent and the hemorrhagic form, which latter may occur as the purpuric form, and a hemorrhagic form in which hemorrhage takes place into the pocks or from the mucuous membranes.

The invasion of smallpox begins suddenly, and is usually ushered in with a chill. It may or may not be followed, but usually is attended, by severe aching in the small of the back and limbs, sometimes with intense headache, always with vomiting and with a fever reaching 103 to 104 degrees Fahrenheit. The pulse is rapid and strong. Convulsions may occur in children. There is an initial rash, which usually appears on the second day in the form of a definite redness. These are of almost universal occurrence. According to Osler in about 13 per cent of cases there is an initial rash in the inner surface of the thighs, the lateral surfaces of the thorax, the lower part of the abdomen and occasionally on the anterior surface of the knees and the inner surface of the elbows.

In the *discrete form* of smallpox the eruption usually appears on the third day at the margin of the hairy scalp, around the mouth and on the wrists, At this point, to be thoroughly noted, the temperature, which up to this time has been high, falls to nearly normal. Within twenty-four hours the eruption becomes general over the body, and at this stage of the disease there is a strong resemblance to measles. On about the fourth or fifth day of the disease the eruption becomes papular and there is noted by passing the fingers over the surface a shotty sensation, viz., as if small shot were imbedded under the skin. About the sixth day these papulæ become vesicles, which vesicles change to pustules. The stage of pustulation is attended with a sinking in the center of the pustules, or umbilication, and each pustule is surrounded by a red border. This ushers in the stage of suppuration and the secondary fever comes on, the temperature rising again rapidly and being strictly a fever of suppuration. It is not infrequent that an eruption makes its appearance on the mucuous membrane of the throat, fauces and pharynx twenty-four hours before its appearance upon the cutaneous surface.

About the twelfth or thirteenth day of the disease the pustules begin to dry up and form scabs. These scabs fall off in the order of their appearance upon the body. The temperature falls, soon reaches normal and convalescence begins.

In the *confluent form* the initial symptoms are more intense and the

eruption may occur a little earlier. The papules are discrete, but the vesicles and pustules coalesce, especially upon the face, hands and feet, and there is of course a great deformation and swelling of the face, and there is swelling of the lymphatic glands, salivation, possibly diarrhea and almost always acute albuminuria.

I feel that this description is brief to the point of meagerness, but it must be apparent to you, gentlemen, that a week could be easily spent in a minute description of all the clinical features of smallpox and even then leave the subject improperly described.

Vaccination. I have already gone into the technique of vaccination. Vaccination should begin naturally with the "contacts," or those who have been exposed directly to the infection from the first declared case of smallpox. The area of vaccination should be greatly extended, and if the disease threatens to spread, vaccination in a community should be general. The question may be pertinently asked, What should be the practice in regard to the repetition of vaccination? I think it admits of little doubt that the community should be vaccinated and revaccinated until every one is either protected by vaccination or it has been demonstrated beyond peradventure that individuals are not susceptible to vaccinia. There are quite a number in this latter class. In my personal experience I was vaccinated successfully in infancy, revaccinated successfully at the age of eight, vaccination was unsuccessfully attempted again at the age of eleven, and since that time I have been vaccinated more than thirty times with only one rather imperfect "take." I have seen other instances equally conclusive. It is also reasonable to suppose that a person or persons susceptible to vaccination are to some extent susceptible to smallpox, though the course of the smallpox will usually be modified even by one successful vaccination.

It would seem reasonable, therefore, that vaccination, to be absolutely efficient should be repeated from time to time until a complete immunity against it is acquired. This, it is natural to suppose, would lead to an equally complete immunity against smallpox, though this remains to be demonstrated.

I do not propose, gentlemen, before this audience or at this time in the world's history to defend the subject of vaccination. I confess it with shame that there are some, even in the medical profession, who cast discredit upon the efficiency of vaccination as a protective measure against smallpox. Is it surprising then that there should be a comparatively large number among the many millions of inhabitants of the United States and of some other countries who doubt the expediency of the process and invoke law, sentiment and legislation to prevent the performance of compulsory vaccination?

Management. We now take up the consideration of the management of individual cases of smallpox from a point of view purely sanitary and prophylactic, that is to say, to prevent its spread.

I do not know what the law in Vermont is. I do not know whether under your law the health officer is authorized and empowered to remove

every case of smallpox to a special contagious-disease hospital for treatment. Please note that I use the term, "contagious-disease hospital." I protest with all my power against the term "pest house." Is it surprising that persons stricken with smallpox object to being removed to a "pest house"? The nature of the disease is sufficient in itself without the addition of these terrible sounding words—"pest house"—by which it is presumed that the person who is being removed is loathsome, dangerous and an object to be shunned alike by his friends and the general public. Certainly if the community is provided with a well-built, well-administered, comfortable contagious-disease hospital, the case of smallpox would better be removed there; but if this be not so, or if the objections of the patient's friends or family cannot be overcome, or if he have law upon his side forbidding his removal, otherwise than by his own free will and consent, it goes without saying that the case should be carefully isolated in his residence, preferably upon the upper floor, and that the floor of the house upon which the disease is to be treated should be abandoned by the rest of the family and placed in strict quarantine.

Sanitation and disinfection. The room should be prepared by having all unnecessary furniture, curtains, hangings or draperies removed. It should be upon the sunny side of the house and at the same time capable of being darkened, should be freely ventilated and be maintained at an equable temperature. All bed linen, garments, handkerchiefs, towels, etc., worn or used by the patient and soiled by him should be immersed in a solution of carbolic acid 5 per cent, or a solution of chlorinated lime one or two ounces to the gallon, for one hour, and after this immersion they should be boiled and then laundered, aired and sun dried. The dishes, cups, medicine glasses, eating utensils, etc., used by the patient should be immersed in actually boiling water. Food that has been in the sick room and which is not consumed should be burned either in a stove in the room or, after being covered with a towel wet with one of the above germicidal solutions, should be removed from the room and burned in a stove or fireplace.

As I said before, the room, or preferably the floor, of the house should be in strict quarantine. The patient should be seen only by his or her attending physician and nurse. The nurse should wear easily washable garments, which should be treated in the same way as the bed and body linen of the patient.

We will suppose that a case goes on to a favorable termination: What should be done upon its conclusion? It must be remembered that smallpox is communicable so long as there are any scales about the patient, and even further,—so long as there are any minute scales or epithelium desquamating from the bottom of the pocks or retained in the hairy scalp. The patient, therefore, after the stage of desquamation begins should receive frequent mild antiseptic baths, paying especial attention to the hairy scalp, and should not be considered as safe until a careful examination of the pocks shows that the epithelium or skin at the bottom of the pocks is smooth and shows no tendency to desquamate. Special attention should be

paid to the throat, mouth and nose of the patient. These should be washed or gargled with a mild antiseptic solution, and any towels or cloths which are used to receive the secretions of the mouth and nose had better at once be burned; it is useless to go to the trouble of disinfecting them as is provided in the case of clothing, either bed or body.

These precautions having been observed, the patient is convalescent and the desquamation completed: What should be done with the room? The answer is, It should be completely disinfected.

The methods adopted for this disinfection will vary much with the circumstances. Provided that the room prior to being occupied by the smallpox patient has been stripped of all unnecessary furniture, hangings and draperies, much may be accomplished by washing the walls and floors of the apartment with water, as near boiling as possible, to which has been added a liberal quantity of ordinary carbonate of soda, which should be used in the proportion of about half a pound to three gallons of water. All woodwork about the room and the bed, if a wooden one, should be washed with this solution. If the walls of the apartment are papered this paper would better be torn down, the walls scraped and the paper replaced with new after the apartment has been disinfected by burning sulphur in the room in the proportion of three or four pounds per 1,000 cubic feet of space, care being taken to thoroughly close the room and render it as near airtight as possible and at the same time to volatilize or evaporate water to the extent of half a pint at least per 1,000 cubic feet. This is necessary for the reason that sulphur burned in a dry atmosphere has very feeble germicidal properties, but when hydrated so as to form sulphurous oxide (SO_8) the germicidal effect is much increased, though the penetrating power of the gas is small. The mattress that has been used by the patient, if a cheap one, had better be burned, it being wrapped in a sheet wet with carbolic or chlorinated lime solution before being carried out of the house. The burning should be accomplished under supervision and should be absolute and thorough, because if not it may be removed by some careless or innocent person and the spread of the disease thus incurred.

Disposal of the dead. It is a melancholy fact, gentlemen, that, while the mortality attendant upon smallpox has of recent years much diminished, our art nevertheless is sometimes impotent and death results. What should be the disposition of the remains? The body had better be wrapped without preliminary washing in a sheet, or two or three sheets, wet with a strong germicidal solution such as carbolic acid, chloride of lime or bichloride of mercury 1:1000, and be immediately placed in a metallic or other hermetically sealed coffin. It goes without saying that there should be no attempt at a public funeral. Any funeral services held over the remains would better be conducted in private, and there should be the least possible exposure of persons and the things in the house to the patient or his attendant.

If it be possible, or the sentiment of the community or family be not opposed to it, cremation should be practiced. I am aware that this is fraught

with many difficulties, but simply throw out the suggestion for what it is worth.

Epidemics. Now, suppose that in spite of our efforts the disease spreads: What should be our course? If there are large numbers of patients it will be most essential that a contagious-disease hospital should be opened in the community. This should be in an isolated spot and should be maintained in absolute quarantine. The attending physician had better become a resident during the continuance of the epidemic. The nurses and other attendants about the hospital should be interdicted from passing beyond the quarantine limits, and any necessary supplies for the use of the hospital should be deposited at a safe distance and carried into the confines of the institution without personal intercourse with the outside world.

Cases should be sought for; they should not be waited for to declare themselves. "Contacts" should be vaccinated and revaccinated as already stated, and the vaccination and revaccination should be conjoined with a house to house inspection made at intervals during the period of the incubation of the disease, say every ten days.

This brings up the question, What should be the treatment of "contacts"? My views on this question may be different from those held by some of you; but, believing as I do that smallpox is not communicable until the appearance at least of the preliminary rash, I should say that if it be possible to keep the contacts under observation they need not be quarantined after having been successfully vaccinated. Arrangements should be made for keeping them under observation from day to day, but until they manifest some initial symptom of the disease, as fever, chill, headache or backache, nausea or vomiting, it is not necessary in my opinion to quarantine them. Of course if a contact refuses vaccination, that contact should be placed in strict quarantine during the incubative period of the disease and, this passed, should he again refuse vaccination, he should be kept under observation which will insure him doing a minimum of damage to the community in which he is resident.

Additional remarks on disinfection. We have discussed already the disinfection and purification of the individual room in which a case of smallpox has occurred, but I feel that I would be derelict if I dismissed the subject of disinfection in this curt manner. Suppose that the disease has assumed an epidemic form in a community, that is to say, smallpox spreads and possibly the connection between cases is lost; viz., there is no definite history as to where the case under consideration acquired its infection. Disinfection will then be required of, first, the infected premises; second, the person and his belongings; third, disinfection of vehicles, such as railway coaches in which persons suffering with smallpox may have been conveyed; and, fourth, possibly the disinfection of merchandise shipped from a place in which smallpox prevails; and finally, fifth, disinfection of mails.

In the matter of premises: On the removal of a patient from the house or apartment in which he has developed smallpox, it is always better to have the contents of the room remain *in situ* while a preliminary disinfection

with sulphur or with formaldehyde gas is given. The object of this is to reduce to a minimum the danger in handling articles likely to convey infection preliminary to their final and complete sterilization. The room and its contents, as has already been said, may be disinfected with sulphur or formaldehyde gas, and the contents of the room—bedding, etc.—by burning, by boiling or by steaming in a special apparatus where facilities for these processes are available.

The formaldehyde may be applied in several ways,—either by an apparatus producing formaldehyde direct by the partial oxidation of wood alcohol, by evolving the gas under pressure in an autoclave from one of its commercial solutions which are known as "formalin," "formol," "formolose," etc., or by sheets sprinkled with one of these solutions hung in the apartment to be disinfected, the room being tightly closed. For the production of formaldehyde gas from wood alcohol, twenty-four ounces of wood alcohol should be oxidized for each 1,000 cubic feet of air space of the room. In using the autoclave ten ounces of formalin (40 per cent solution), to which has been added 20 per cent of a neutral salt such as calcium chloride, borax, etc., should be used per 1,000 cubic feet. For the sheet or sprinkling method, ten ounces per 1,000 cubic feet (40 per cent solution) should be sprinkled upon the sheets suspended in the apartment tightly closed. In using the sprinkling method it is essential that the sheets or cloths should not be wet or wrung out of the solution, but that the solution should be so sprinkled as to remain in small drops without coalescing, and thus furnish the largest possible space for evaporation.

I have mentioned sulphur dioxide and formaldehyde as disinfecting agents, and it might be well here to briefly discuss the limitations of each.

Sulphur dioxide is especially applicable to the holds of vessels, to freight cars, to apartments that may be tightly closed and which do not contain objects injured by the gas. It bleaches fabrics or materials dyed with vegetable or aniline colors. It destroys linen or cotton goods by rotting the fibre through the agency of the acids formed. It injures most metals.

On the contrary, formaldehyde gas has the advantage that it does not injure fabrics or colors, except perhaps the most delicate. It is not fatal, however, to the higher forms of animal life, though germicidal to the ordinary forms of bacteria, especially those of the non-spore-bearing varieties. It is effective in a minor degree against spore-bearing bacteria, such as anthrax, tetanus, etc. It is applicable to the disinfection of rooms or clothing and fabrics. It is to be borne in mind that commercial solutions do not contain a full 40 per cent of formaldehyde gas and that all of them are apt to deteriorate with time. A quantity in excess of the amounts prescribed should therefore be used in disinfection, unless the full strength of the solution has been determined by recent reliable analysis.

A comparison of the three methods of using formaldehyde may be of interest. The lamp or generator is easy of application and requires no amount of mechanical skill. The apparatus is heated for one and one-half minutes by igniting the alcohol. The flame is extinguished, and the oxida-

tion of the alcohol then proceeds by means of the platinized surfaces contained in the lamp. The gas is produced regularly, in a form very active and destructive to bacterial life, and is not prone to a change of form or polymerization. The process by this method requires six to eighteen hours' exposure, depending upon the size of the room and the nature of the contents. The sole disadvantage of the lamp is that the gas is produced rather slowly, but it leaves little or no odor when applied to clothing and textiles. The articles to be disinfected should be suspended in a tight room and so disposed to permit free access of the gas. The wood alcohol used should be 95 per cent strength, and should not contain more than 5 per cent of acetone.

The autoclave process has the advantage that the gas is evolved rapidly, but the autoclave is in fact a steam boiler operating under considerable pressure, from forty-five to sixty pounds per square inch. It is somewhat liable to get out of order, requires a considerable degree of mechanical skill to operate it, and is prone to rapid deterioration. A further disadvantage of the process is that the gas evolved is exceedingly prone to polymerization into paraform or trioxymethylene, and this polymerization, combined with the neutral salt, calcium chloride or borax, which it is necessary to use, leaves a disagreeable odor upon fabrics or garments submitted to its action. The paraform deposited has a tendency to volatilize upon every elevation of temperature, evolving further quantities of formaldehyde gas, which is irritating to the eyes and respiratory mucous membranes.

The limits of either of these processes as to size of rooms, buildings, or apartments to be disinfected have not as yet been accurately worked out, though the matter will be taken up shortly; but it is known that for rooms such as are found in ordinary dwelling houses, both methods are efficient, and experiments have shown that this efficiency extends to apartments of very considerable dimensions.

The spraying or sheet method of formaldehyde disinfection gives unequal results, and should only be used in the absence of the apparatus mentioned above.

We have already discussed disinfection of clothing, bedding and the articles used in the treatment of the sick. Where these are of value they should be boiled or steamed. When not of much value they had better be burned without further delay.

The dejecta of smallpox patients should be disinfected in carbolic acid solution 5 per cent, tricresol 1 per cent, or a solution of chloride of lime or milk of lime. If smallpox has declared itself in a person during transit on a railway or other public conveyance, no article used by him should be thrown away en route, but they should be gathered, kept as carefully as possible and at the end of the journey be disinfected or burned. Railway coaches may be disinfected, as well as sleeping cars, by any of the methods given for the disinfection of rooms, but particularly by means of formaldehyde gas, using the generator for direct production of gas from wood alcohol or the autoclave.

The disinfection of merchandise is seldom if ever required, as new merchandise is seldom infected. Surface disinfection at most is all that would be required, and for this sulphur dioxide or formaldehyde by any of the methods given is ample.

The mails emanating from an infected locality should be disinfected by formaldehyde or by sulphur dioxide, methods for accomplishing which disinfections have been prescribed by the Post-office Department.

SCARLET FEVER.

I am going to ask your permission to depart from the order of the caption laid down in my address and take up next the subject of scarlet fever, for the reason that in certain important particulars there is a strong analogy between smallpox and scarlet fever.

Beyond doubt smallpox is caused by a specific germ. Of the nature of that germ we are as yet uncertain in spite of the recent discoveries of Councilman; but in all probability it is a protozoön and not a bacterium. The same statement applies to scarlet fever. We do not know as yet the specific cause of scarlet fever, though it has been attributed both to protozoa and bacteria. Time will not permit that we should go into the consideration of scarlet fever with even that degree of minuteness with which we have treated smallpox, incomplete though that treatment has been.

Symptoms. Scarlet fever is a highly communicable disease. It is probably to be accepted as a type of the communicable diseases and the infection, using the term in its broadest sense, is, while not very resistant, quite long lived. It is usually a disease of childhood, though it may take adults at any time of life. The reason for the communicability of scarlet fever is that it is a disease attended by very extensive desquamation, amounting in many instances to a complete peeling of the cutaneous surface of the body, and the infective principle, whether it be bacterial or protozoal, is conveyed in these scales or particles. In addition, the contagion or infection of scarlet fever can also be communicated by the nasal and buccal secretions, and as scarlet fever is always attended by more or less sore throat, this sore throat being a very severe and a most prominent symptom in some cases, it is a disease of easy spread unless stringent precautions are taken.

It is also very possible that the disease may be conveyed by the other secretions of a scarlet-fever patient, such as the urine and fæces. Also, possibly the vomited matter, though this may result from the fact that the vomit has passed through an infected throat.

Scarlet fever being, as has been intimated, usually a disease of childhood, it is to schools public or private that we must look primarily as a means for the dissemination of the disease in a community. Unfortunately we are not at this time in possession of a prophylactic measure against scarlet fever as we are in vaccination against smallpox. Therefore, we are not able by one general method to prevent the spread of the disease. I think,

therefore, it is fair to assume that, given a case in which scarlet fever has appeared among the pupils of any school, it would be well either to close that school or to make frequent—possibly daily—inspections of the health of the rest of the scholars. This inspection should take into consideration the general condition of the child, whether he presents suspicious symptoms—complains of sore thorat—or presents evidence of a commencing infection of any kind, as is noted by the symptoms of a bad cold, suffused eyes, or a coryza.

Sanitation and disinfection. The sanitary treatment of scarlet fever in a household should be upon the same general principles that have been outlined in the case of smallpox. The patient should be kept in an isolated room, preferably in the upper story of the house, and should be guarded from contact with all save those absolutely necessary to care for him, his physician and nurse. It is not our purpose to follow the clinical course of the disease, but during the height of the disease care must be taken to disinfect all discharges from the patient, especially the secretions from the nose and mouth; secondly, from the bowels and bladder; but it is only when the height of the disease is past and the brilliant scarlet eruption gives place to a commencing desquamation that the real trouble begins. This desquamation is a natural process and must go on. The outer layers of the skin have been rendered dead by the disease and must be eliminated, and so long as this desquamation continues the patient is a dangerous object and a source of infection to others. During the peeling or desquamatory stage of scarlet fever the patient's skin should be bathed once or twice a day with a germicidal solution. A weak solution of carbolic acid, not exceeding 1 or 2 per cent, should be used to bathe the entire body surface and especially the hairy scalp. The use of carbolic acid in children under ten years of age is not unattended with danger; therefore, some other antiseptic sufficient in power but mild in character may be substituted. A saturated solution of boric acid is a good one, and it is well that this solution be rendered decidedly alkaline by the addition of a small quantity of carbonate of soda. The throat should be gargled frequently and the nose cleansed with a mild antiseptic; boric acid is probably the best solution for this purpose.

So long as a single scale is visible about the skin or upon the scalp of the child, so long is the child capable of conveying infection, and should not be released from quarantine until this process is entirely at an end.

The same care should be taken with the bed and body clothing of the patient as was recommended in smallpox. Articles of value should be boiled or immersed in a strong germicidal solution. The carbolic acid solution is here good; or, if facilities are available, they should be thoroughly disinfected by steam. In removing the articles from the sick room to be either boiled, burned or steamed, care should be taken to envelop them in a sheet wrung out of one of the strong germicidal solutions.

A great source of the spread of scarlet fever has been the fact that the books, toys, or other articles used for the amusement and entertainment of

the patient are not disinfected at the end of the sickness. If these toys, or books, or playthings are of little value they had beter be burned. If value is attached to them, either by their intrinsic worth or by association, they may be disinfected at the end of the illness by sulphur dioxide, by formaldehyde used by any of the methods prescribed as for smallpox, or, if permissible, by immersion in one of the strong germicidal solutions.

I do not intend to again go over the whole subject of disinfection with the minuteness with which I treated of it in the case of smallpox. Any one of the methods outlined in the treatment of that disease is applicable to disinfection after scarlet fever. I attach particular importance to formaldehyde, because sulphur dioxide is destructive and injurious to fabrics and textiles. Particular attention should be paid to the walls, and to cracks and crevices of the sick room. The quantity of epithelial detritus which results after an attack of scarlet fever is great beyond all belief, and so long as this is not reached by a disinfecting agent the room is dangerous for occupancy by others who are not already protected by a previous attack of the disease. Great attention should, therefore, be paid to washing the floors and scrubbing the walls of the apartment. If care has been taken in the early stages of the illness to remove all unnecessary articles from the room an excellent plan would be to subject the room to a preliminary disinfection by sulphur dioxide, this to be followed by a scrubbing with a strong soda solution and a subsequent application of formaldehyde gas by any one of the three methods which have already been brought to your attention.

Concluding remarks. I feel that I have dismissed this part of the subject briefly, but I do not wish it to be considered alone by what I have said, but rather by what I have referred to in the previous account of measures to be taken for the prevention of smallpox.

Isolation and disinfection are, therefore, our greatest safeguards in the prevention of the spread of scarlet fever, and these measures may, in the discretion of the health officer, with advantage be supplemented by house to house inspection, as has been recommended in the case of smallpox, and the immediate isolation of all children or adults who present the initial symptoms of the disease.

DIPHTHERIA.

The time at our disposal being short, I am going to pass on to the subject of diphtheria.

Etiology. Diphtheria is an acute, specific, communicable disease caused by infection with the Klebs-Löffler bacillus. It is unnecessary to point out to you at this day that the principal local symptoms of diphtheria are referred to the throat where they are made manifest by the exudate or false membrane, highly fibrinous in character, which has given the disease its name, from the Greek διφθερον, skin. It is to be distinctly understood, however, that diphtheria is to be regarded as a local infection with constitutional manifestations: the local in the throat, the larynx and in many cases in

the nasal passages. The disease is, therefore, a distinctly bacterial infection, whose degree of communicability is very great. The virulence of the organism varies, and also the degree of susceptibility of different persons. The infectious agent is the Klebs-Löffler bacillus, and this is contained in the secretions of the mouth, throat and nose, and may also be sometimes present in the blood, causing a true septicæmia, and may in exceptional cases be contained in the bladder and fœcal discharges of the patient.

Prevention. In the matter of prophylactic measures diphtheria must be considered as occupying a medial position between smallpox—against which there is a well-recognized protection—and scarlet fever, for which we have as yet no well-authenticated prophylaxis. It is needless for me to bring to your attention that most wonderful discovery of the nineteenth century, the diphtheritic antitoxin announced conjointly and at the same meeting of the International Medical Congress by the two eminent scientists, Behring of Frankfort, and Roux of Paris.

In the diphtheritic serum we have an agent of wonderful properties, an agent that has reduced the mortality to a degree which will ever render these two scientists the admiration of the scientific and lay world, and in the same agent we have at our disposal a measure of distinct prophylactic value.

I think it is not necessary in this gathering to go into the subject with great minuteness; but, as in the case of scarlet fever, schools, public and private, and congregations of children for purposes of instruction or amusement, are agents for the dissemination of the disease. A school in which diphtheria has made its appearance in the person of one or more pupils should be closed until thorough measures of disinfection can be applied to the building, and during the period of incubation of the disease it would be decidedly advantageous to have all pupils of the schools subjected to a thorough and oft-repeated medical inspection, particular attention being paid to the general condition of the children, and more especially to the condition of their throats and of their nasal mucous membranes. Every case of sore throat, mild or grave in character, should be subjected to bacterial diagnosis, and whether the symptoms are urgent or not, isolation of every child or adult presenting suspicious microscopical forms in their throats as a result of these cultures should be isolated until the disease is frankly announced or until suspicion is removed. These examinations should be frequently and thoroughly repeated.

Sanitation and disinfection. The sanitary treatment of individual cases of diphtheria should be conducted upon the general lines given for scarlet fever. The patient should be isolated in a room, and there should be no communication with the patient except on the part of necessary attendants, nurses and the physician. The danger being in the Klebs-Löffler bacillus being contained in all the secretions of the mouth, throat and nose, it is obvious that these secretions should be thoroughly disinfected as soon as eliminated, and that cloths, handkerchiefs, etc., used to receive them should be either thoroughly disinfected or promptly burned; I am decidedly in favor

of burning. The same measures apply to the bed and body clothing of the patient as apply in the case of smallpox or scarlet fever—they should be disinfected either by burning, boiling, or by steam.

I do not intend here to enter into the treatment of diphtheria by the administration of antitoxin, but I do distinctly place myself upon record as saying that the physician who neglects to employ antitoxin in the treatment of the disease lays himself open to criticism and deprives his patient—child or adult—of the very best means known to modern science in the cure of a dreadful malady. The question of immunizing contacts by doses of the prophylactic serum is one that the physician must decide for himself, and in this he must be governed largely by the prejudices of the parents and friends of his little patients. Speaking for myself I should say that, given a large family—especially one in which children predominate—it would be the wisest measure to administer a prophylactic dose of diphtheria antitoxin. It can do no possible harm and may be the means of averting an attack of diphtheria and of preventing the spread of the disease beyond the house in which it first appeared.

The same general principles as to the disinfection of articles in the sick room and the sick room itself as given for scarlet fever and smallpox apply in diphtheria. Especial attention should be paid to the drinking vessels and eating utensils, and these should always be thoroughly sterilized with actual boiling water. On no account should food which has been exposed in the room of a scarlet fever or diphtheria patient be used by anyone else, but should be promptly destroyed. Again, in both scarlet fever and diphtheria we are confronted with the possibility that all of our efforts to cure disease and to prolong life may be inefficient. The same measures given in the case of scarlet fever and smallpox should be taken in regard to the disposal of the remains of the deceased. They should be wrapped in sheets wet with a strong germicidal solution, the body at once closed in a hermetically sealed coffin and burial should be prompt; there should be no attempt at anything partaking of the nature of a public funeral. As in the case of smallpox, cremation would be advisable did facilities exist and the prejudices of friends and relatives permit.

CONCLUSIONS.

I am going, gentlemen, to bring this address to a close without further comment. I have already said much, though much also remains to be said.

The three subjects committed to me for discussion are so vast that volumes might be written upon their management, but the time allowed me is that given to an ordinary address, and this time I am afraid I have exceeded. I shall lay down certain axioms for your consideration and then close:—

1. In the case of smallpox, *vaccinate, isolate* and *disinfect.*
2. In the case of scarlet fever, *isolate* and *disinfect.*
3. In the case of diphtheria, *isolate, administer antitoxin* and *disinfect.*

Had I said nothing more than to give these three closing remarks I would have covered the subject, giving you these cardinal principles, and leaving to your intelligence and experience the methods of carrying them out.

Discussion by Dr. C. H. Beecher, Burlington, Vt.

It is a pleasure to open a discussion on this subject, although there is little left for me to say, but I hope to emphasize a few of the important points brought out by this valuable paper.

As a rule, the cases by which epidemics are started are the mild or rare forms of disease which are unrecognized: as an illustration, during the last two or three years, there have been several well-marked cases in connection with smallpox. Quite recently, I am informed, one case of hemorrhagic smallpox was to blame for a very serious epidemic. There was another instance here in Burlington, where the epidemic was practically under control, when a mild case was not recognized and thus spread an epidemic for the second time. The cases by which the epidemics are continued are the rare forms of disease, but more especially from the convalescent cases liberated while they are still infected. The convalescent cases which are more apt to give trouble are perhaps the diphtheritic. The routine has been established here of liberating from quarantine only after subsidence of physical symptoms and after two negative cultures have been taken. The bacilli may persist in the nose and not be present in the location from which the culture is taken. The remedy that suggests itself in the treatment of convalescent cases is more thorough treatment of the nose and accessory surfaces a week after the clinical symptoms have subsided, and at least two negative cultures.

We hear more or less of the presence of diphtheria in healthy throats, and, with the idea of finding out the truth and the percentage of healthy throats infected, Dr. Stone and I have made in the last six months some one hundred and twenty-five cultures of presumably normal throats, when there was no epidemic and from all classes of people. In one of these cultures we found the bacilli two and a half months ago and we still find them. These cases have not developed diphtheria or spread any epidemic, and are evidently non-virulent.

Again let me say look out for the mild forms of disease and be sure of your convalescent cases before you liberate them from quarantine.

Discussion by Dr. S. E. Darling, Health Officer, Hardwick, Vt.

I will take but very little of your valuable time in the discussion of this very interesting and instructive paper.

I wish to speak especially in regard to the early diagnosis of smallpox, and its importance, and where it is impossible to make an early diagnosis, it is of the greatest importance to quarantine the patient as a suspicious case until a positive diagnosis can be made.

Three years ago we had an epidemic of smallpox in our town which ex-

tended over several weeks, and during that time we had all varieties of modified smallpox in this one epidemic, which originated from one patient who brought the disease from outside of our state. If it had not been foı the fact that one case was a very serious case, a confluent variety, and whc just barely escaped with her life, quite a good many of our citizens would tell you that we had no smallpox.

At the present time we have a few cases in our vicinity which have been very difficult to diagnose. If one had not seen a mild case of smallpox, it would be almost impossible to diagnose these cases.

We had during this epidemic, one case where a gentleman had contracted smallpox from his daughter, who had a typical case; and we had another who was not sick enough to confine him to his home; he did a good day's work up to the time the eruption made its appearance. It came out in the form of papules and vesicles. He made a good recovery. Such a case where there is no known exposure, would be very difficult to diagnose. The diagnosis had been made of Cuban itch, and others diagnosed it as Cuban fever.

With mild cases, which you suspect to be smallpox, I feel that you should quarantine them immediately and make your positive diagnosis later

Dr. Giddings speaks in his paper of vaccination as one of the first means of prophylaxis. Vaccination is prophylactic against smallpox, although I have seen some cases of varioloid after vaccination.

A man in our town had smallpox in a mild form, and he claimed that he had been vaccinated; another had smallpox and later was vaccinated, and he claimed that he had a typical vaccine vesicle; this demonstrates that vaccination will work sometimes after a mild form of smallpox.

Discussion by Dr. E. F. Norcross, Island Pond, Vt.

After hearing this exhaustive paper and these two other gentlemen, I feel as though I had but little to say, but inasmuch as my name is down on the program, I will relate a little experience which has been my pleasure and privilege to go through during 1902 and a part of this year. I have had more or less connection with twenty-five cases of smallpox located in two well-separated places. One was a lumber camp where there were seventeen cases of smallpox. In the management of these cases we employed vaccination as a prevention and isolation against spread. We were very favorably situated, and they were very submissive to the rules and regulations we adopted. The intention of the people in charge was to purify this camp by fire when we got through with it. The building we used was a log cabin, and it was the intention to burn it up this spring, but the cabin had been locked up, and owing to the drought, it is still standing and guarded. I hope it will be burned before long. There was no spread of the disease from this camp. One man was brought in there after the disease had been pretty well dispensed with, so I postponed the length of time after this man entered for the quarantining.

The other place where we had smallpox was very different. It was in a family composed of nine people, and the infection was brought from Canada. It was very interesting, and I was very much absorbed with it. The first case was that of an employee in a shirt factory. This factory employed about two hundred hands. This young man had visited in Canada, and on his return, on Monday, went to work. He was slightly indisposed. He returned to his room that afternoon, and the doctor he called said he thought he had a slight attack of the grip. Tuesday he went to work, but was indisposed and returned home again. The doctor was again called and said he had better stay at his boarding place for a day or two. Friday a wood team came down to this place, and this boy slipped out of the house and went home on this wood team.

On January 15 this case was brought to my attention; I reported same by telephone to the State Board of Health, and I was directed to go to the boy's house and make an examination. By the aid of a lantern I succeeded in getting to his place, and the man there was very much surprised to see me, and when I asked him if any of his folks were sick, he said no. I went in, however, and stated that his home was my port of destination. The family all seemed well and were about the house. I enquired for this boy, and the father said he had retired. I asked to see him. When I went into the room, I held up my lantern, and that was enough; I could see very clearly that I had a case of smallpox. I stepped out and said, "Your house and you all are under quarantine," and I reported my findings to the State Board of Health. I recommended vaccination There were seven persons in the house. The real head of the family, the boy's father, and his mother were away. Before the disease had run its limit they returned. The household was composed of a man and wife, and her father who was seventy years old, son and daughter, two small children, and a young man working there. The supply of cats and dogs was numerous. The cats were killed and all the dogs save two, which they were allowed to keep as they were quite valuable. I advised vaccination, but they refused it. I had no authority to enforce it. Dr. Stiles of the State Board of Health came and visited the family. He recommended the same thing, but they would not submit. Consequently we let them have their choice. Every member of the family had smallpox in a more or less modified form except the old gentleman, who had been vaccinated, and as well Mr. and Mrs. Perry, but the others had not been. This young man had a typical case. The other cases in the household were mild. So far as the medical treatment of the twenty-five cases is concerned I cannot speak very definitely. The only medicine they took was plenty of gin; they all enjoyed it very much, and they all seemed to get along very nicely. During this sickness they became very discontented and wanted to get out. I did not feel inclined to let them out. At the end of the disease I was called upon to look after the cleaning up of the house. We have got along very well so far. I told the parties concerned that I was doing the best I could for them. This farmhouse was not in very favorable condition. The people had

a preference as to who should clean the house up, and it was not I. But I went there. The means I adopted were sulphur, sulphur candles, formalin, liquid and candle, and I succeeded in getting up quite a moral effect. I used sulphur in the cellar and garret. We depended on the gas in the living rooms. The clothing was hung up so as to get the fumigation. We gave the patients a bichloride bath. We took two days to do the business; we did not want to leave any of the details unperformed. We took the dogs into consideration; we gave them baths and put them in sacks and tied them up around the neck. When I finished I put in my bill for the fumigation of the house, the nine persons and the two dogs, but I have not been paid as yet.

Discussion by Dr. C. A. Perry, Readsboro, Vt.

I don't know as I can give you any instructions regarding treatment of smallpox; however, it is true I had quite an extensive experience in the treatment of diphtheria.

The first epidemic of diphtheria was in 1860. It has been my misfortune to be in the midst of three serious epidemics; the last, some twenty-five years ago, was in the town of Readsboro. My rights extended for about ten miles. The epidemic continued there for about five years. There would be a lull, and then there would be a breaking out of the disease in an aggravated form. There were over six hundred cases, and during that time I lost something like one hundred and fifty patients, so that I have nothing very pleasant to report to you. I can't recall a single instance where I received any beneficial results until I commenced using calomel in very large doses. In that way I saved a great many cases. As soon as there was anything on the market that gave any promise of benefit, I was the first to take hold of it, and for the last number of years I have been called outside quite a little. I have been called to Adams, Northampton, and neighboring towns. I have used antitoxin, and I have carefully observed its effects. My observation has resulted in this, that I am inclined to use that in large doses also. I have learned, furthermore, that it requires a larger dose for a young child than it does for an adult to get a good result.

Week before last I was called to see a patient, and when I entered, I found I had a case of diphtheria. There were five small children in the family, and four boarders and a man and his wife. The children had gone to school, and the man had just come home; he showed a well-developed case of diphtheria. I immediately gave him six grains of calomel to clear out the intestinal tract. I got 2,000 units of antitoxin and injected it in the shoulder blades. The temperature at the time was 105. I saw him again in the afternoon; again the next morning at 5 o'clock his temperature was 102; at noon 101; and at night his temperature was 101. The next day it was normal, and the examination of the throat showed the membrane was curling over. The following evening I was in there; he coughed and ex-

pectorated quite a little mass. Immediately his throat got better, and the fifth day from the time I was called there I sterilized the house.

In regard to the care of patients. I placed this man in a room and had everything removed except the bed and the clothing upon the bed. I wet all the clothing that he used with a solution of bichloride and burned them immediately. After the close of the disease I have of late been using formalin pastils and lamp; that has been the most satisfactory to me. I fill the lamp two-thirds with alcohol and place the pastils above and light the lamp and place it on a table and retire. I leave it there two days and then enter, take my lamp and go home. In every family I insist upon using at least 1,000 units of antitoxin. I think diphtheria can be stamped out if we go at it thoroughly. If the temperature does not drop and the appearance of the membrane does not improve, I repeat the dose in eight hours, or more frequently until I get the desired results.

Discussion by Dr. G. H. Branch, Grand Isle, Vt.

What is the maximum dose?

Dr. C. A. Perry, Readsboro, Vt.

Four thousand units.

Discussion by Dr. G. H. Branch, Grand Isle, Vt.

I had a young person under my care; I had to administer 16,000 units in order to get any results. I used not only one company's preparation, but all three. I had six cases and lost one patient. In one case I was obliged to use 16,000 units before I got the curling over of the membrane. It was used in thirty-six hours.

Dr. C. A. Perry, Readsboro, Vt.

We have got to accomplish our results immediately, or we are apt to fail.

SOME WHYS, WHATS, AND HOWS OF VENTILATION.

BY PROF. S. H. WOODBRIDGE, MASSACHUSETTS INSTITUTE TECHNOLOGY.

The "whys" it is proposed to discuss at this time are: Why is ventilation a necessity? Why is artificial ventilation imperative? Why is the quantity of air needed for ventilation greatly in excess of the quantity breathed? Why is there in ventilation so much of capricious art, and so little of established science?

First, then, Why the demand for ventilation? For precisely the same reason that a draught is required for a steam boiler fire; because all energy, or capacity for doing work, whether mechanical or vital, is not

created for doing the particular thing to be done, but rather, is converted from some preëxisting but perhaps unusable form of energy into a form which can be harnessed and directed to our use. For ages the only forms of energy known as available for human use were the so-called vital or physical force in man and animals; the dynamic force of winds, by which man sailed his ships and turned his windmills; and the gravity force of waterhead, by which he turned his water wheels. It was only when man came to a knowledge of the immense energies about him ready to his use, upon which he had only to lay his appropriating and directing hand, that he began to develop rapidly into the modern proportions, and activity, and power, which places the productive work of the man of to-day in such marked contrast with that of his ancestors of two centuries ago. Among those transformable energies is that which exists in the physical segregation of matter, and which the energy and force of gravitation tend to aggregate. Thus, if two great celestial bodies, moving toward each other under the action of mutual attraction, collide and crash, the energy of gravitation acting in and through those bodies changes into energy of mass-in-motion; and when such bodies strike upon and crash into each other the energy of the mass-in-motion is partially, or might conceivably be wholly, changed into the energy of molecules-in-motion, or molecular vibration. To put the matter more technically, in the hypothetical case, the energy of gravitation is changed into that of energy of motion and of mass; and when mass-motion is arrested the energy changes again into that of molecular-vibratory-motion, which the physicists term heat. Heat is to-day the most easily producible and readily usable form of energy. The falling together of Mars and the earth would produce a conversion of enough gravitation energy into thermal energy, or heat, to melt and partially vaporize both planets.

At present, thermal energy derived from gravitation energy is not to any large extent available for man's use. There are other abundant and more easily accessible or convertible energies more readily transformable into the usable energy of heat. As by the impact of great or small bodies, under the action of gravitation, heat results, so by the impact and the compact of atoms, due to the action of resident chemical energy, heat, or thermal energy, is likewise developed. The atoms of oxygen combine, because of inherent chemical energy, with atoms of carbon or of hydrogen, and chemical energy is thereby transformed into thermal energy. It is through this process of transformation from chemical into thermal energy that the great store of energy in nature is made available for man's use. By the chemical combining of one pound of carbon with two and two-thirds pounds of oxygen enough chemical energy is converted into thermal energy to raise a ton's weight from the sea level nearly to the summit of Mt. Marcy.

The rate of energy transformation of our time, and the energy resources available for our use, are roughly indicated on the one hand by the thousand million tons of coal mined per year, and on the other by the one thou-

sand million million tons of oxygen in the earth's atmosphere; a supply of oxygen which, by a marvelous process of nature, is replenished as fast as it is exhausted.

Ventilation may, for our present purpose, be defined as that process by which atmospheric oxygen is brought, in sufficient quantity and purity, into effective contact with the substances with which it can chemically combine to produce a transformation of chemical into thermal or thermo-vital energy. By ventilation our lamp flames glow, our boiler fires burn, our vital fires are sustained; for what oil is to the lamp, and fuel to the boiler, so food is to the body; and to each atmospheric oxygen is as essential as is oil to the lamp, or as fuel to the furnace, or as food to the body.

This, then, is the answer now offered to the "Why" of ventilation:—The body is an energy transformer and user, and the transformation process requires oxygen, and the oxygen is furnished by the atmosphere, and the movement of the air furnishing the oxygen is ventilation.

Another "why" with which this discussion is concerned relates to the necessity for artificial ventilation.

Ventilation always has been, and always will be, wherever there is air. All over the face of the earth the air moves under the action of solar heat, and under the resulting warming and lightening of air, and the evaporation and condensation of moisture. And that moving air drifts through the canopy and open house-shelters of the equatorial zone, and in colder climates and seasons seeks out and courses through every available airway through the wall-construction which separates the warmed air within from the frigid air without.

The fundamental purpose of a building is the protection of that which is housed within it. The primary function of a building for housing living occupants is to protect those occupants from outside conditions adverse to health, and to maintain within the building such conditions as are requisite to health. The outside climatic conditions which are averse to health are wind, storm of rain and snow, cold and heat, and, in some localities, and at some times, dust.

The early habitation constructions were open, suitable for privacy and defense, for protection from solar heat, and from the fierceness of storm, but open to moderated air flow. Only by slow degrees were they warmed, except by open fires which warmed the air enclosures much as bonfires warm the air of the hemispheres in which they burn, and which warmed occupants who stood or sat about them only by radiant heat emanating from the coals and flames of the burning fuel. The great cavernous chimneys carried away from 90 to 95 per cent of the total heat of combustion, and drew from the rooms great volumes of air. That withdrawal of air from the rooms necessarily induced an equal inpour of outside air through every chink and crevice and cranny, and though every pore open to the searching quest of the environing and in-pressing outside air.

Those were days of excessive ventilation and deficient warming, and of inordinate waste of fuel; the vacuum period of ventilation, when ventilation

was accomplished by rarefaction within doors, and when compression out of doors sent in through every findable way in the outside walls (innumerable in the aggregate for every enclosure), a jet of cold air, which chilled floors and froze into icicles the sap which oozed from one end of the logs while the other ends burned in the hearth fire; which made cold floors and insufferable draughts, and compelled the use of high-backed and close-bottomed settles as a battlement against the assaults of the stealthy and incessant inroads of the outside adverse conditions, to which, with the vacuum conditions within and a pressure condition without, no ordinary wall offered more than a semblance of protection.

Such conditions were too faulty and intolerable to permanently continue. The cost of fuel; the insufficient protection from outside cold; the discomfort and the danger attending a method of warming which—because those seeking the benefit of the fire could not be, or would not suffer themselves to be, rotated before it on spits—baked one side while the other side suffered with cold; all these losses and penalties attending the primative method of protection against outside cold, resulted in changes which made outside walls tighter, and the method of fuel combustion much more productive of available heat, and the indraught of cold outside air vastly less, and interior thermal conditions agreeable rather than intolerable.

The change which vastly bettered the indoor thermal conditions worked disastrously in an unguarded direction. In shutting out cold by tightening walls, and by reducing or removing the vacuum or rarified conditions within rooms, the air, which was the vehicle of that cold, was also excluded, except as, by its own molecular activity and under greatly reduced pressure, it still coursed its way through the fewer and the narrower channels now left to its finding and flowing.

Meanwhile, as houses became tighter, population became denser, and buildings larger and more crowded, until the ravages of plague and disease, and the impotence of human and animal vitality to resist their assaults, alarmed the humanitarians of the latter seventeenth and early eighteenth centuries. With diligence they looked for the cause, and as they discovered it began the work of removing it, and of warding off the disasters attending previously half-made moves for humanity preservation.

It was about one hundred and eighty years ago that there lived in England a French physician and scientist, Desaguliers, who attributed many of the physical ailments afflicting humanity to the absence of a normal relation between life and its sustaining environment, the maintenance of which is indispensable to physical vitality. Chief among the lapses between humanity and the sustainers of its life, he found gross ignorance and negligence in the matter of the relation of air to that life. He devoted much study, and freely expended his own private resources, in the humane endeavor to better these ills. He introduced the word "ventilation" into the world's vocabulary, giving the name to the current of air delivered from the crude fan which he designed for forcing air into enclosures, and the further name of "ventilator" to the man who presided at the crank of this machine.

He is the father of modern artificial ventilation, made necessary by the limitations put on natural ventilation by the modern methods of building and of living.

During the one hundred and eighty years since his day, there have been those who have thought, and talked, and written about ventilation; who have planned ventilation; and in one way or another have applied ventilation to various kinds of work, and with varying degrees of success and of failure. To-day we are to add to these years one more hour of thought and of talk.

The third "why" which it is proposed to discuss relates to the largeness of the air quantity usually demanded for ventilating work as contrasted with the quantity actually breathed.

The quantity of air breathed by an adult in a state of repose, averages about fifteen cubic feet an hour. Why then should the air supply demanded by authorities on hygiene range from fifteen hundred to three thousand cubic feet per breather an hour, or from one hundred to two hundred times the quantity actually used in breathing?

If the reason already given for the necessity of ventilation be accepted as the fundamental and all-inclusive one, then it may be naturally affirmed that the larger the supply of oxygen fed to oxydizable carbon or hydrogen, or other substance, the more intense the combustion rate, and the more rapid the transformation of chemical into thermal energy. The stronger the draught the hotter the furnace fire, the brighter the lamp flame; and, likewise, the freer the ventilation the more vigorous the vital fires.

Manifestly, however, there is an economic limit to the proportions between the quantities of combustible and the furnished oxygen. A flame can be easily blown out of existence by an over supply of air. A boiler fire may be greatly lowered in effectiveness by too much draught. The vital flame may be, and often is, put in jeopardy by a too free flow of air. For each boiler fire, lamp flame, or animal furnace there is a quantity of air which corresponds with the highest economic effectiveness. To fall below that results in dullness. To pass beyond it wastes through the unusableness of the excess, and the dissipation of otherwise effective results because of that excess.

Why, then, is the demanded supply for maximum economic effectiveness large as compared with the actual quantity of air breathed? The answer is this: the oxygen quantity is not the sole factor in the problem. The gold fish would find in the ocean more water than it ever dreamed of while basking in its native pond, and yet would quickly die in that boundless expense of watery wealth. Why? Because, for all the water, its composition, or contents, are not those to which it is by nature adapted. There is in nature an exactness of adaptation between conditions and productions which cannot be ignored, or even slightly departed from, without marked and sometimes startling effect on the character of the product. The difference between the softest iron and the hardest steel is in a thousandth part of constituent carbon. A change of one five-hundredth in the makeup of

air, by removing one one-hundredth of the oxygen, and substituting for it carbonic acid gas, the product of carbon oxidation, will reduce the light of a candle five one-hundredths. That is, a change of one in the air will produce a change of twenty-five in the light. The brilliancy of lamp and gas flames burning in the close air of crowded and poorly-ventilated rooms is sensibly dulled as compared with the brightness of the same flames when burning in pure air. Windows and doors have been opened to save lights when the jeopardy to the life and health of the assembly has received scant attention.

Breathing changes the air. It reduces its oxygen and increases its carbonic acid gas. If, then, exhaled air is mingled with the air supply—just as if the chimney gases from a boiler fire were mingled with the draught supply to that fire—the necessity for a large increase in the air supply over the volume actually needed, could the air reach the fire or the lungs uncontaminated, is evident.

This question is like that of water supply. Suppose a summer boarding house to be located near a water brook fed from mountain springs. How much water must flow through that brook to properly supply that summer resort? If the house takes its supply from up stream, and discharges its drainage down stream, then a flow through the brook just equal to the supply to the house might answer. If, on the other hand, the sewage discharge from the house is up stream, and the water supply is taken from down stream, the volume of water flowing through that brook must be a thousand-fold more than the actual supply to the house, before the proportions of water and waste shall be accepted as tolerable.

That up-stream drainage and down-stream water supply correctly represents artificial-ventilation methods by the ordinary dilution process, and for the purposes of the present discussion, it sufficiently demonstrates the necessity for a flood of air in ventilating work, as compared with the relative rivulet used in the respiration process. Urine can be drunk with less immediate danger to life than expired breath can be rebreathed. There should be as large a proportion of air furnished to dilute expired breath for purposes of respiration, as should be used to dilute urine to make it potable. One hundred to one? Two hundred to one? Who would be found to object to such proportions as unduly wasteful of water, or as wholly unnecessary for the protection of health?

Having thus dealt, in an elementary way, with three of the fundamental "whys" of ventilation, attention may be not improperly directed to a single incidental "why." If ventilation is a matter of such vital concern, why should its status as a theory and a practice have been so long characterized by an absence of a rigidly scientific and universally accepted basis, such as all the great lines of sanitary engineering theory and practice are solidly built upon? The answer is to be found in the occultness of the subject.

A prolific source of vagueness, in all thinking about the nature and the application of ventilation, is that it has largely to do with things that are invisible and intangible. Ventilation has to do with air and life. Both air

and life are invisible. It is impossible to get a glimpse, by telescope or microscope, either of the principal atmospheric impurities with which ventilation is concerned, or of the insidious working of their poison. Air moves, but no one ever saw its motion. Air moves only through paths of motion having more or less definite boundaries and limits, but those boundaries and limits are not fixed by visible confines. Air moves only by the action of a causative force; but that force is invisible, as is often also the medium through which it acts. That is to say, the air, the purity of which is desired; the pollution which necessitates ventilation; the movement which effects ventilation; the paths and the limits of air travel; the forces which cause, direct and modify the movement of air, are all intangible and invisible.

Whatever is invisible and intangible is, to the human mind, more or less shrouded in mystery, and may be made, if it is not liable, to assume, crude, grotesque and fantastic forms, through which with much vagary, and oftentimes quackery, and here and there with other and enlightened and redeeming endeavors, it comes at length to a sound basis of scientific theory and practice.

Occultness, in whatever field, is the wedded mate of mystery, and the prolific offspring of both are the isms and schisms which distract and distress and hamper humanity, the source of those perpetual growing pains through which humanity comes to its adolescence in medicine, in theology, in electrology, and in ventilation, in which last are found the plenumists, the vacuumists, the upwardists, the downwardists, and humidists, and other hobbyists.

According to the degree of occultness, there is therefore a corresponding need of completeness and correctness of knowledge. In the absence of these, imagination and vagary assume the place of knowledge, and quackery first precedes and then often subverts sound technical practice. Half knowledge, and corresponding practice have from the first been and to-day remain, the bane of the science and the art of ventilation—in the understanding of its functions; in the application of its processes, and in the judgment regarding its operation and results. Happily, the trend of events is now away from vagary and quackery toward the correctness and precision of true engineering.

Turning, now, from "whys" to "whats," the foremost pertinent question is, What is ventilation? The question has been already answered, in a general way, as the furnishing of air in sufficient quantity and of standard quality for effecting the transformation of chemical into thermal or other usable energy by methods of the highest effective economy.

By derivation from the Latin, ventilation means a diminutive wind, such as was produced at the mouthpiece of Dr. Desagulier's machine. Real ventilation is, then, a breezy movement of normal air which sweeps away from the places of their origin all oxidation products and accompaniments, and brings a continuous flow of oxygen to maintain the process of energy transformation; as the out-of-door wind carries away, out of all possibility

of return, respiration from lungs, transpiration from pores of the skin, all heat and vapor, all floatable dirt, and odors from the person and clothing; as the draught carries away the gases, and smoke, and heat, and vapor of the boiler fire, or of the lamp flame, and brings to the fire and the flame the full supply of needed oxygen.

A mild out-of-door wind always produces effective ventilating results. An out-of-door wind, of ten miles an hour travel, brings to the breather standing in its current more than 300,000 cubic feet of air per hour. That air impinges on him; bathes him; takes up his spent breath, his perspiration, the effluvia of his person, the odor of his clothing, everything the air can hold or float, and hurries it to leeward beyond all possibility of return. In such ventilation the breather is furnished with air borne to him out of native purity, and all impurity, of his own creation, is carried clear away on the wings of that wind.

That is true ventilation. It is ideal in method and in ventilation results. Nothing more complete can be proposed. That ventilation furnishes an unsurpassable standard of excellence.

What, then, are the distinctive features of artificial ventilation as contrasted with perfect ventilation? Indoor, cold-weather ventilation is not, and cannot be made to be, out-of-door ventilation. Such ventilation would not be endured within doors. Instead of 300,000 cubic feet of air per person per hour, as in out-of-door ventilation, 3,000 is considered a large supply for indoor ventilation.

Instead of an air movement impinging on the person with a velocity of nearly 900 linear feet per minute in the out-of-door "little wind," thirty feet is all that is admissible for indoor work.

More, and worse, than that, instead of carrying away exhalations, and other impurities from the breather, the ordinary house ventilation can only dilute such impurities in the air which slowly circulates about the room, to surely return them to the occupant for his breathing.

This, then, is the unavoidable and great difference between true and imitation ventilation. Out-of-door ventilation by a small wind is ventilation by a flowing flood of air; indoor ventilation is by a trickling rivulet of air. Out-of-door ventilation is by the swift impact of large volumes of air upon the breather; indoor, is by the slow distant circulating of air about the breather. Out-of-door ventilation is by an air movement measured by feet per second; indoor, by inches per minute. Out-of-door ventilation sweeps away waste, and pours in a continuous stream of pure air; indoor ventilation mixes all floatable impurities with the air supply, and returns to the breather his off-casting in diluted form.

When, therefore, in the popular mind, the results of artificial ventilation are measured by the results of out-of-door ventilation as standards, what is more reasonable than that confusion should result? that expectations are disappointed? that ventilation is sometimes proclaimed as an undiscovered, erratic or undeveloped art? All this arises from general imperfect knowledge of the essential, and unavoidable, differences between real and artificial

ventilation; between out-of-door and indoor, or natural and artificial, ventilation.

If, then, ordinary artificial ventilation is of necessity so limited and imperfect in action, what may be properly demanded of it?

The proper work of artificial ventilation may be stated to be the maintenance indoors of air which shall differ from out-of-door air by a certain amount, and in a certain particular, fixed for each case. If that is done, the ventilation doing it is perfect of its kind. The particular difference fixed upon as allowable between inside and outside air may be in one, or another, or in several of the air's chemical proportions, or of its physical properties. That difference may be in moisture, or humidity; it may be in smoke; or in temperature; or in carbonic acid gas increment; or in oxygen decrement; that is, in atmospheric composition, or contents, or qualities.

In what the difference between indoor and outdoor air in any particular instance shall exist, is generally determined by the conditions peculiar to the individual case. In a dye house, or paper-machine room, the proper and appropriate standard of comparison between inside and outside air is in the matter of moisture; in a blacksmith shop, or in a smoking room, it is the matter of smoke; in a furnace or stoker room, or in a kitchen, it is, perhaps, heat; in a water closet, or sanitary room, it is likely to be odor.

In the ordinary ventilating work for occupied enclosures, the commonly accepted standard is carbonic acid gas. This is for the reason that the rates of the normal eliminations of impurities from the body maintain very nearly constant ratios to each other. If the percentage of one is increased, the others are likewise increased. So much air is breathed; a corresponding quantity of carbonic acid gas is produced; and so much heat is generated by the body and given to the ambient air; and so much vapor is perspired, and so much effluvia is eliminated from the system. That being so, if any one of the quantities can be determined, the others can be approximately measured.

Of all the eliminations from the body which are the products of the processes of energy transformation within it, carbonic acid gas is the most easily detected and captured; and its quantity can be measured by simple and reliable means. Of all the group of offenders, it is the most easily apprehended and made to divulge its evidence. Carbonic acid gas is not the worst culprit of its group. It is not the most dangerous member of the "gang" to which it belongs. Others are quite as bad, and in some combinations worse; but it is easily caught in the chemical net, and measured in the chemical balance.

For this reason it is so much talked about that it has come to be thought of as the thing the presence of which makes the air of poorly-ventilated rooms bad, and the absence of which makes the air of well-ventilated rooms good. We must, however, clearly understand that carbonic acid gas is accepted as the standard for general ventilating work for the sole and simple reason that the energy transformation process within the body changes the air proportions and contents and properties through the entire range of

oxygen decrement, carbonic acid gas increment, vapor, effluvia, heat, and odor; and because, when the body is in a normal condition of health and cleanliness, any increase in carbonic acid gas, due to the presence of the body in the air, indicates a corresponding increase in the elimination accompaniments. It is for these reasons that, in ordinary ventilating work, carbonic acid gas is accepted as a convenient, reliable and safe indication of atmospheric purity or impurity, although as a standard, in itself, it relates solely to the proportions of the gaseous constituents of the air, and to nothing else.

For all practical purposes, then, it may be said that the function of general ventilation, applied to occupied buildings, is to maintain within such enclosures air which shall differ from outside air, in the matter of contained carbonic acid gas, by so many parts; let us say in ten thousand parts of air. The standard may then be expressed in this way, assuming a particular case: The inside air, let us say, for that particular case, shall contain not more than three parts in ten thousand of carbonic acid gas in excess of the carbonic acid gas in the outside air. If this is effected, in the case to which it refers, then the work of artificial ventilation is complete. Nothing more can be demanded of it.

What are the proper standards of good ventilation? Is the rigid standard of carbonic acid gas proportion in the air universally applicable and uniformly sufficient?

Ventilation which is gauged and governed solely by carbon dioxide proportions, though complete as artificial ventilation, is not, and cannot be made to be, such as to be a guarantee of satisfaction. The accepted standard for artificial ventilation is a definite carbonic acid gas increment. The standard for satisfaction is the perfection found in out-of-door ventilation. The standard for artificial ventilation is one of chemical proportions; the standard for satisfactory ventilation is one of personal sensations. Chemical proportions are definite, and easily determined; personal sensations are indefinite, and variable with the same individual, and widely different among those making up almost any group of people.

The standard by which the work of artificial ventilation may properly be tested is, therefore, at variance with the popular standard by which that work is almost invariably judged.

Purity of air is not enough to insure satisfaction with ventilation. The air which is perfectly satisfactory at a temperature of 65° to 70° becomes close, stuffy and oppressive at a temperature of 75° or 80°, and is so even though the air may be purer at the higher temperature than at the lower. So, also, the very air which when dry is invigorating becomes enervating and intolerable when the humidity is high. Temperature does not change the constitution of the air; nor does moisture much affect the proportions of the gases which make up the atmosphere, but both affect the sensations. Temperature and humidity have more to do with the general agreeableness of air than have oxygen decrement or carbonic acid gas increment, or than the usual impurities incident to the occupancy of enclosures by breathers.

An offensive odor has many a time been the cause of a most unqualified condemnation of good ventilation. The infinitesimal amount of matter needed to produce even a strong odor in a large enclosure for a protracted period is well known. It is said that on opening an unearthed chamber there was found (where it had been for more than 2,000 years) a vial containing musk. The chamber was filled with the odor of musk, and the weight of the musk as recorded on the vial was said to be almost exactly that which it was found to weigh when discovered. Air which may be classified as chemically pure may yet be nasally abominable. Here often the scientific standard and the popular standard are at variance. The scientific standard is right, and the popular standard is wrong. The popular demand that ventilation, to be perfect, should keep rooms free from sensible impurity is also wrong. It can no more do that than it can free rooms from too high temperature in hot weather, or from stuffy humidity in dog days. The sources of heat must be otherwise controlled. The state of humidity must be otherwise regulated. The occasion of the offensive odor must be removed by means quite apart from any functionary work of ventilation. Ventilation can neither wash soiled clothing nor make unnecessary the proper use of the bath tub. The laundry, the toilet, soap suds, and the scrubbing brush must precede ventilation. Ventilation succeeds only where cleanliness precedes.

Successful work and satisfactory results in ventilating undertakings cannot be had until incorrectness and crudeness of thought regarding the nature and proper functions of artificial ventilation are put aside, and its inherent and inevitable limitations are accepted as necessities, and its prerequisites of cleanliness and temperature and humidity are accepted as fundamental.

Because artificial ventilation is, and must be, imperfect, as compared with out-of-door and natural ventilation, it is not therefore unimportant. It is, rather, vitally important. Though by means of such ventilation indoor air can never be made as pure as out-of-door air; though it must pour its ærial refuse into the up-stream and take its supply from the down-stream, so furnishing refuse in dilution for breathing; though it cannot eradicate odor, or otherwise insure agreeableness; it can do that which is of as much greater vital concern for those for whom it is provided as life is greater than a passing sensation; or as the preservation of health is of more importance than the maintenance of atmospheric constituents in their exact normal proportions; and as the fostering of vitality is of greater moment than gratification in the pursuit of a hobby.

To belittle and refuse artificial ventilation because it is and must be imperfect, is like shutting off the water supply from a thirsty city because the lake water is not hygienically pure; or like the condemnation of humane measures for restraining men from the drink habit, because those measures are adapted to the disordered conditions of an unredeemed, rather than to the well-ordered conditions of a redeemed, society.

What volume of air is needed for artificial ventilation? This question can be answered by reference to the analogous ventilation of a boiler fire. How much draught does a boiler fire require? The draught required depends on

what kind of fire is wanted; what work is expected of the boiler and its engine. To keep alive a banked fire, to make no steam and do no engine work, needs only enough air to keep fire in the coals. The boiler system—fire, steam engine and plant—is then effectiveless, without either power or product. To make the system productively active, increased draught is an absolute necessity, and the power of the system will be—up to a certain limit—proportional to the draught furnished. Beyond that limit the increase in draught results in decrease in available power in both boiler and engine.

The same is true with reference to the vital furnace. Its fire may be kept barely alive with a supply of, perhaps, sixty cubic feet of air an hour; but all vital processes of body and of mind would then eventually be only those of unproductive existence. With increase in air supply comes a greatly increased development in vital power, activity and productiveness.

It must be noted, however, that the energy gain is not proportional to the rate of air supply. The first increase in the per capita air supply, let us say by 100 cubic feet per hour, greatly increases the vital energy; still another increment of 100 cubic feet of air supplied, and again the advance in working energy is marked, but less so than before. With each added 100 cubic feet, there is a gain, but a decreasing gain as the air quantity is increased, until a point is finally reached where the vitality gain due to the progressive air increase falls short of being profitable, and becomes a loss.

If the question is reduced to one of mere economic balance between fiscal output and physical input, between costs in fuel and gain in vital energy, there would be an evident absurdity in furnishing ventilation which would be like providing a Lake Champlain for a single trout. Where the true economic balance falls in each case must depend on worth, the worth of coal on the one side, and the worth of the benefited vital power on the other. As has already been said, some vitalities, physical, mental and moral, are of such large worth that large expenditures for their quickening and increasing to the highest attainable degree are clearly justifiable. On the other hand, no human vitality is so valueless that the cost of maintaining it at its highest normal efficiency is not only warrantable, but morally obligatory. The only question is as to the refinement of such betterment, as to the point to which it may be profitably carried.

What, then, are the limitations of artificial ventilation? As the boiler draught should have reference to boiler work and boiler capacity, so ventilation for the maintenance of the vital fires should be regulated with sole reference to effect on those fires. Unquestionably some combinations and functional activities and products of body, mind and spirit—like those of some rare combinations of machinery device—are such that any obtainable increase in their productiveness is worth, perhaps, far more than it costs to effect that increase, and for such vitalities ventilation may be profitably excessive, just as for such machinery boiler fires may be advantageously forced. On the other hand, when the vital, or the mechanical, system is deranged, and abnormal conditions prevail, when depleted fires need quickening to save them and to maintain the factory work, and when vital functions

flag and life's sensitive flame flickers, then, to save all which is represented in the fire and in the flame, draught is given full force, ventilation is made excessive in its freeness, and even pure oxygen is furnished to tide the flickering vital flame over its crisis. The limitations of profitable ventilation are, therefore, fixed by a more or less wide range of conditions peculiar to each case.

For general ventilating work, however, it may be said that the air supply advantageously usable is limited solely by two drafts—one the air draft, the other the bank draft; or, first, the menace of air in sensible motion while the body exposed to the air current is at rest; and second, the money cost of warming air. The sensible air draft attending the issuance of air into rooms varies greatly with the manner of that entrance, the temperature and humidity of the entering air, the per capita space within enclosures, and the per capita rate at which air is furnished, and the susceptibility of occupants to chill by moving air. Except for the menace of the draft, the larger the air supply the better the hygienic conditions within enclosures. Because of that menace, ventilation must not be pushed to cross the danger line of sensible draft.

The breeze draft is one to be dealt with, reduced, and subdued by the engineer, one of whose chief functions it is to supply the maximum air quantity with the minimum draft effect and a maximum ventilating result. When the limit of his ability to produce draftless movement of air is reached, his limit of supply is also reached. The draft limit varies from one thousand to fifteen hundred cubic feet per capita per hour for crowded places, to from three to five thousand, and upward, for sparsely occupied rooms.

Within the limitations imposed by the bank draft the engineer has also a most important field of operation. Upon him rests the responsibility of resulting effectiveness, or wastefulness, in the use of air for ventilating work. Air may flow through buildings without doing much, if any, ventilating work, just as water may run through the raceway of a mill without productive mill results. It is the province of the engineer to make the water mechanically effective in the mill, and the air ventilatingly effective in the building and room.

This second limitation is in the cost of air warming preparatory to use for ventilation, and in all want of effectiveness in the use of that air for ventilating work. Low efficiency in ventilating work is the more costly, as the warming of air is costly, and the warming cost increases with the range in temperature through which air must be warmed for ventilating use, the warming cost being the same for any given air quantity warmed through a certain range of temperature, whether the ventilating efficiency is high or low.

One of the most valuable opportunities for service on the part of the engineer is that of securing for his client the surest and the highest return for his investment; first, in the installation provided; and second, in the fuel quantity required for air-warming; and finally, in the effectiveness with

which air is used for ventilating work. The great gulf stream flows, eighteen million millions of tons an hour, four or five thousand miles, over the Atlantic without mingling with the great waters beneath, and about it, and carries over the cold and undisturbed depths of the ocean to the lands of northwestern Europe, great stores of tropical heat. So air, passed through rooms, may flow within restricted channels, above, or beneath, or about, the quiescent mass of air in a room, neither mingling with nor much disturbing that air, nor diluting its deleterious contents. To change that active but ineffective current into one which shall pervade the entire enclosure, which shall continuously include in its movement the entire body of the enclosed air, which shall reduce to a minimum the amount of contained impurities, and also the time of their retention within the enclosure, as well as the space they occupy within it; all this is the service the engineer can render in the field of the working economy of ventilation.

It is the disagreeable office of the engineer, at times, to disclose the wastes in systems of the "gulf stream" order, where the volumes of air-flow are made more impressive than effective, the actual effectiveness in some cases falling to one-third of that obtainable, and users paying for actual ventilating work obtained three times the necessary cost. Because of the invisibility, and intangibility, and elusiveness of air, its wastes, and the money wastes which they involve, are too often unobserved and unconsidered.

The necessary cost of warming air to prepare it for its ventilating work is, roughly, that of a ton of coal for each twelve million cubic feet of air raised from 0° to 70° Fahrenheit. The supply for the Edmunds High School, in this city, is intended to be and actually is fifty thousand cubic feet per minute, or three million cubic feet per hour. The average daily burning of coal for warming this air, and apart from warming the building, is one-half a ton of coal; and for the school year, of 150 working days, seventy-five to eighty tons.

By as much as the efficiency of the ventilating work in this school, or elsewhere, drops below 100 per cent is the cost of that work increased. Reduced to 30 per cent efficiency, the cost of doing its ventilating work would be raised to 300 per cent of its proper cost. Hence the equal economic importance of a correct layout for effecting the highest efficiency in ventilating work, and of an operating engineer who shall intelligently and faithfully and skillfully use the apparatus for its intended purpose.

In the keeping of that man, more than of any other connected with that school building, are the health, comfort and the working ability of its five hundred occupants; with him is the care of a $12,000 plant; the burning, for use or for waste, of some 250 tons of coal a year. The responsibilities of such a service demand higher attainments than those which qualify a man for shoveling coal and ashes, or for sweeping floors, or for wielding feather dusters.

What are the benefits derivable from ventilation?

The benefits of ventilation are both immediate and temporary, and also cumulative and permanent. By adequate supplies of pure air vitality is en-

ergized; mental acumen is quickened; work is increased in quantity, and bettered in quality; the body is fortified against disease; and sickness, beside being made less liable, is less severe when it comes; premature decline and untimely death are warded off; life's work begins earlier and lasts longer; and is made more remunerative and otherwise profitable when the atmospheric oxygen requisite to the development and maintenance of vital energy is liberally supplied.

In the case of the schoolhouse, it is found by some to whom thoroughness of investigation, and recognized professional standing, bring the weight of authority, that among the immediate and temporary results of generous ventilation is such betterment in the amount and accuracy of work done that a gain approximating 20 to 25 per cent is observable as compared with the work done in inadequately ventilated rooms. Applied to your Edmunds High School, and stated in terms of dollars and cents alone, and with sole reference to immediate and temporary results, the profit and loss account may be stated thus: 500 scholars at a yearly cost to the public of, perhaps, $50 each equals $25,000, the annual cost of the school. The cost of an absence of adequate ventilation may then be put down at $5,000. The cost of supplying adequate ventilation, in fuel, eighty tons, in dollars, $400. Interest on the plant for ventilation alone, that is beyond requirements for heating, $200. Annual repair cost on the same, and cost of renewal of such plant in thirty years, $150. For ability and faithfulness of fireman above that required for heating alone, $250 per year. Total $1,000. That is, the absence of ventilation would cost the public, in immediate and temporary results, $5,000. The furnishing of ventilation costs $1,000. The gain is therefore $4,000, or roughly 400 per cent on the fresh-air investment, and 16 per cent on the total high-school investment.

The gain or the loss of that per cent, in immediate and temporary matters, is largely in the hands of the man put in charge of the people's "black diamonds," the man in the cellar, hidden out of sight beneath the walls and floors and paraphernalia of the schoolhouse, just as effectually as is the vital importance of his work obscured by the invisibility of the air, the occultness of its impurities and of its movements, and as is the invisibility of the vitality itself for which ventilation is maintained.

The man who has his hand on the breathing system of a school building is, economically speaking, the most important man in it. That man should be selected with as much careful reference to his qualifications for his particular work as should be the head master for his work. He should be recognized as selected and employed for a vitally important service, and he should be compensated with due reference to the responsibility and valuable nature of his service, as a conserver of the life of the public's youth, and as a steward of the people's investment in their public schools. Rightly regarded, he must be taken out of the darkness of the cellar, and from the usual invisibilities of his calling, and be placed and held in the full light of the facts we are now focusing upon him.

What is the avoidable waste in the chief item of the cost of ventilation?

The way in which the school janitor burns the people's coal is a matter of sufficient economic importance to warrant more than passing consideration. The untrained and indifferent fireman may evaporate but five pounds of water into steam for each pound of coal burned, while the capable and painstaking man may easily evaporate from eight to nine pounds. If the proper per capita amount of coal burned, for the heating and ventilating combined, is one-fourth to one-fifth of a ton per year, the cost of unskilled and slovenly work in the fireroom becomes evident in the case of a single large building, and startling in its aggregation when the entire school population of a state is considered. For each one thousand scholars, the per annum fuel loss through faulty firing may be $\frac{1000}{4} \times \frac{4}{9} = 110$ tons, or $500 to $600, or from fifty to sixty cents per scholar. Presumably, the per annum preventable loss actually incurred by the public, due to this cause, is not less than twenty-five cents per scholar in most of our communities. The probabilities are that such loss more nearly approaches fifty cents.

The avoidance of such loss fully warrants the small expense necessary to secure the skilled labor needed to insure good firing for any single building, and would justify the cost of schooling all public firemen by an expert in firing, appointed and paid for the purpose. The "chief" should then either operate a plant as a continual object lesson and school for the other public firemen for the district to which he is appointed, he being chief engineer or foreman, and they serving in rotation as his assistants in his boiler room until he graduates them as thoroughly trained in the burning of fuel and the making of steam; or else he should supervise the firing in every boiler room in his district.

But here, again, the immediate and tangible, weighted against the remote and invisible, is likely to turn the scale to the side of the "penny-wise and pound-foolish." The immediate and visible dollar which might be paid for competence too often outweighs the ultimate, cumulative and unobserved loss in tens, if not hundreds, of dollars.

This baneful propensity toward a readiness to save one seen dollar by a method which involves the loss of ten unseen dollars, is the root of much evil in schoolhouse economy. It results in prodigality through wasteful use of fuel in the cellar, and in waste through bad hygienic conditions in the school room.

Turning now from such "whys" and "whats," brief attention will be given to some of the "hows" of ventilation.

Applied ventilation is a matter of physics and mechanics. An intelligent discussion of the many problems incident to such work involves a knowledge of the principles of physics and mechanics, and of the practical application of those principles. Without such knowledge, and without experience in its application, vagueness, misunderstanding and misapplication are likely to result from any attempt to prescribe methods. As physicians, you understand the dangers attending a practice of medicine by a layman prepared for the service by two or three hours' attendance on lectures and clinics. You

can therefore understand all hesitancy to introduce you to the large range of applied ventilation, and, much more, to conduct you through it. Elementary principles only can be here no more than briefly noticed.

Air has two kinds of movement; one molecular; the other molar, or movement in mass. The quietest air, the air of this room, however stagnant it may seem, is in a state of high activity. The molecules about us are moving with the velocity of revolver shots, in zig-zag, irregular courses, like minute insects in a great buzzing, but stationary swarm. The other motion of the air is in current form, or mass flow, like the swarm in flight. By molecular action air moves through porous walls and floors and other partitions of building construction. By mass movement it flows through channels, openings minute and large, flues, chimneys. It is with the latter motion through provided ways that artificial ventilation is concerned, and upon which it depends.

How can the flow-motion of air be secured and directed to ventilating work?

Such flow can be due to but one cause, namely, the action of an unbalanced pressure on the air in motion. Such resultant pressure may be due to the dynamic action of wind; to unequal weights of equal volumes of air, because of difference in temperature, in humidity, in gaseous constituents; or to pressures produced by fans, pumps, air or steam jets, water spray, or other mechanical means.

The flow of air through a building for ventilating purposes may be effected by a method, or by a system. A room ventilated by a hole in the wall or the roof, or by open windows or doors, is ventilated by a method rather than by a system. Methods, as by open doors, windows, or by fireplace flues, or by flues heated by steam pipes or furnished with fans, are generally simpler than are systems.

A system—a placing together—is an assemblage of related parts, combined with reference to some functionary end or service. A system of ventilation includes inlets for fresh air; treating chamber for warming or otherwise preparing air for this use; distributing channels for delivering air to rooms; diffusing means for insuring effective distribution of air throughout room spaces; extracting channels for the discharge of spent air; mechanism or other means for moving air and for controlling its rate and volume of flow; furnaces, boilers, heaters required for air warming.

A single room may be ventilated either by a method or by a system. The present brief discussion must be limited to ventilation of rooms by methods or semi-systems, rather than made to include ventilation of buildings by systems, simple or complex.

First of all among methods is spontaneous ventilation by the unintended, the unpreventable movement of air through walls and buildings. Building material, brick, stone, wood, mortar are as open to the movement of air molecules as would be a very deep mesh of felled trees to the falling through it of an orange. A molecule of air has an estimated size which is to an orange as an orange is to the earth. Imagine an orange expanded to the

size of the earth, and all its proportions, in texture and porosity of skin, likewise increased. That skin would then become like the greatest trees of the forest felled tree on tree, four hundred miles deep, without the crushing effect due to the accumulated weight of mile on mile of trees so felled. Drop into this mesh of tree network an orange, and let it travel as it may, through the branches and between the trunks, downward through four hundred miles, and we may imagine the movement of the air molecules within ordinary building material. In inconceivable numbers atmospheric molecules are moving in this manner through the walls, floor and ceiling about us—the movement being both inward and outward in almost equal quantities. Through the porous mass of brick, and board, and plaster the molecules of air dart in swift, zigzag motion, with the velocity of a rifle shot; but with an advancing, retrograding and arrested motion; and with the aggregate result that much outside air enters, and much inside air escapes; and ventilation, unobserved and unprovided for, thus does its quiet, unobtrusive, beneficent auxiliary work. The value of such ventilation, and also of that which takes place by current leakage through cracks and crevices in walls, about windows and doors, into basements, and out through roofs, all other things being equal, is proportional to the surface through which such molecular and current movements may take place. In other words, in any particular case, the value of such ventilation is proportional to the per capita area of the wall between inside and outside air, and to the physical structure of that wall.

In the dwelling, the per capita surface of walls is large; and in the schoolhouse it is small. Therefore, in a dwelling not used for assembly purposes, such ventilation, which we have called spontaneous, becomes an important auxiliary to the air supplied by specially provided means.

Experiments indicate that the movement by such molecular travel of air is commonly sufficient to cause a volume of air equal to the contents of the rooms to enter through the walls of ordinary dwellings, exposed on all sides, once each sixty to ninety minutes. The part which the spontaneous, unintentional and inevitable movement of air through building material and construction plays is large in buildings requiring but a small total air supply, such as dwellings, offices, etc., and small in those to which the air supply must be large, as in the case of schoolhouse and assembly rooms. The value of spontaneous ventilation is inversely as the total volume of air supply required for any given work. To that incidental, accidental, unobtrusive and unappreciated ventilation, most home dwellers owe more than to ventilation by design.

It now remains to speak, cursorily, of provided methods of ventilation. Of these the number and variety are too numerous to receive even mention. A glance at the roofs of this or any other city would reward the observer with evidence of human ingenuity, as well as of a proclivity to resort to chimney-pot methods and devices for effecting ventilating currents. The patented inventions covering chimney-pot and cowl designs in this country alone are said to have reached the extraordinary number of eight hundred. Pots and cowls have their proper uses, but for the most part they are "proclamations

on the house tops" of hidden failings within, failings which pots and cowls can neither remove nor more than partially remedy. Their inventors seem to be possessed with the one idea that ventilation consists "in getting a move on" air, somehow, to some extent, and that all that is needed to effect such "move" is to mount their particular device on house and chimney tops. They proceed on the plausible assumption that ventilation consists in extracting air from enclosures, and that the function of the cowl, and their own cowl in particular, is to extract, because it is a cowl, and is designed and made and patented for the particular purpose of extraction; therefore it must extract; it can do nothing else, no matter as to wind direction or force, and with as little reference to size and carrying capacity of the flues, or in other words to the volume of air moved. With them extraction is ventilation, and the patented cowl is the guarantee of extraction.

Other and, it is pleasing to note, fewer actual or would-be contributors to ventilating work, do not aspire to chimney tops and ridge lines, but content themselves with windows. One perforates the glass pane, and inserts a wheel which rotates as the air moves through it in or out, and it is proclaimed "a pump for forcing pure air in," "or foul air out," according to the interpretation of its action which may chance to be most pleasing to the seller, or the user; the little innocent wheel meanwhile hindering the movement of the air either way, being made to move by the air flow through it, instead of making the air to flow by its own self-created rotation. It serves meanwhile the dual and generally unrecognized purpose of effectively diffusing air, and of placating some conscience in its demand for ventilation.

And then come the window-sash ventilation undertakers, with their clever or cheap devices for letting the outside ocean of air leak into buildings. Perhaps under the six lower sashes of a school room may be placed twelve apertures, two inches by eight inches, three quarters filled with some sort of mesh for "filtering out the dust" and fascinating the imagination. The total free area for air flow is $2 \times 8 \times 2 \times 6 \times \frac{1}{4}$ inches or 1-3 square foot. Suppose the inflow through the mesh holes to be 700 linear feet per minute. The per minute volume is then but 233 cubic feet as against the 2,000 cubic feet demanded for good ventilation. Such ventilation promoters are impressed by, and impress others with, the velocity of air inflow. Velocity of current flow is so generally and successfully persuasive that due regard to the area of that flow is not given. Ventilation, however, can be affected only by an air volume needed for ventilating work, and volumes of flow are always determined, and can be furnished, only by the two equally important factors, velocity and area.

Another class of would-be ventilators find the all-important requisite of ventilation to be an arrangement, or application, not at the top of buildings, nor at midway windows, but at the bottoms of buildings, at the air intakes.

One man discovers a great universal law of nature, applies it in a widely advertised way to ventilation, and proceeds to ventilate great buildings by the motive force contributed in the heat of a single candle or gas flame; and many a moth has been scorched in that flame, but under the anesthesia of

ignorance and imagination, may have neither felt nor known the scorching.

All such methods illustrate the endless variety of devices made either to serve the purposes of ventilation, or else to serve as substitutes for appropriate means. The designers and promoters of such inventions are to be ranked as benefactors, much as is the man who comes into the market with an "electro-magnetized" hair brush. Any man who will induce the great unkempt and uncombed public to brush its hair is a benefactor, even though his motive is no more philanthropic than to sell brushes, and to attract men to hair brushing by a real or an alleged magnet hidden in the back of the brush.

Such methods stand for practices which do more to satisfy a demand for ventilation than to really effect it. Ventilation should be furnished, and here are the manifest evidences that provision for ventilation is made! The demand is satisfied, imagination is gratified, while results are sacrificed to imposition and to placating demands. Too much attempted ventilation is of this pseudo character.

No presentation of correct or complete methods for affecting ventilation can be attempted in this discussion. The subject is too complex, the methods too numerous, the conditions which should determine the choice of means are too varied to make even an outline discussion of them profitable. Such a discussion is more appropriate to the technical lecture room or an engineer's office than to a public platform. To attempt it here would almost inevitably invite the danger of misinterpretation and misapprehension on the part of amateur experimenters. Appropriate methods are as varied as are the types of buildings, the uses, the exposure, the internal arrangements and other features which affect the requirements of buildings.

The two essentials to good ventilation are, first, an air supply correctly proportioned to the impurity to be removed and to the manner in which it is to be removed and to the standard of purity to be maintained; and second, the furnishing and use of that air in a manner which shall effectively accomplish the ventilating work desired.

Air quantity is a matter of flue area and velocity of air flow. Air distribution and effective ventilating work within rooms are matters of appropriate methods of securing a maximum efficiency as determined by the uses of rooms, by locations and manner of arrangement of inlets and outlets, by exposure and use, and their effect on the character of air currents within rooms.

Into the intricacy of such matters it is neither proposed, nor is it possible, to enter at this time. As a guide, however, to the obtaining of adequate air quantities for ventilating work it may be said that when air flow depends on differences in air weights because of unequal temperatures, and when the air passing through flues is not heated beyond temperatures required for house warming, and when flues are without horizontal runs, and are straight, smooth and of even size, and of such form as to provide maximum area with minimum peripheral or frictional surface, the per capita area should be not less than twenty inches for flue systems sixteen feet high, sixteen

square inches for flues twenty-eight feet high, fourteen square inches for flues forty feet high, thirteen square inches for flues fifty feet high, the temperature difference being 35° in each case.

As a general direction for the avoidance of waste and to secure efficiency in the use of air within rooms, the following approximate rule may be of some value. The outlet should be so placed that the air supplied to the room must travel the longest possible path from the inlet before it can reach the outlet, that path being determined by the temperatures of the inflowing and of the ambient airs, the disposition, character and temperatures of the cooling and precipitating surfaces which carry the inflowing air to the floor; the air-warming surfaces which carry the air ceilingward; and the resulting trend of air movement within the room across ceiling and floor and over outer and inner walls. In ordinary cases a correct observance of this rule would result in placing the outlets near the floor and at a point as far removed as practicable from the outer wall.

The subjects discussed to-day have been, What? Why? and, incidentally, How? Why the necessity of ventilation? Why the necessity of artificial ventilation? Why the largeness of the air supply demanded for ventilation? Why the laggardness of ventilation as a science? What the nature of artificial ventilation? What its narrow legitimate functions? What its cost? What its profit? What its avoidable wastes? How can air movement for ventilating work be effected? How is such movement ineffectively imitated by the use of inappropriate means? How may the fundamental principles underlying correct procedure in ventilating work be stated? Why? What? These are the basal questions appropriate for public discussion. Upon the intelligence, the persistence and the generalness of that discussion must depend the effectiveness of the demand for reasonable and appropriate artificial ventilation. That demand is the precursor and the progenitor of the after question—How?—a discussion of which is here prohibited because enforced brevity would make such discussion profitless; a question the answers to which are properly so varied that not so much as a brief summarization can be made without grave risk of misguiding the amateur and disappointing the experimenter.

The purpose of this discussion is gained if what has been said has sent through the hazy maze of popular conception and misconception which envelops ventilation, a shaft of light which shall disclose its outlines and proportions in normal perspective.

Discussion by Mr. Frank Austin, Burlington, Vt.

I was unfortunate in not hearing all of Prof. Woodbridge's paper; but what I heard was indeed very interesting to me as well as instructive.

The ventilation in the Odd Fellows' Hall at Middlebury, upon which I have been working, will cost between two and three hundred dollars. The hall accommodates two hundred men. I say plainly there have got to be

laws made to regulate the ventilation of public buildings. I looked the matter up regarding such laws applicable to the State Board of Health, and find none touching on this subject. Now, laws which were good and adequate ten years ago are unfit to-day.

The first month after an appointment as health officer one is supposed to know as much about the ventilating of a building as a man who has made it his life's work. I think the suggestion which I wish to make might reap benefit to all of our people as well as to the State Board of Health. I think we should have an engineer or an expert to inspect buildings, and houses, and churches. The ventilation and plumbing of a building is a science. There are many architects who have experts employed in their offices who have made ventilation a specialty. I think we should have on the State Board of Health a man who is an expert on ventilation and plumbing. We should see that the laws regarding these subjects are properly framed. I don't know how it is throughout our state, but here in this city we have a building inspecting committee appointed by the aldermen; one member of this committee is a mason, one a carpenter, and the other a plumber. I think those inspectors should be in touch with the State Board of Health; and if every town had a like committee, the State Board of Health could require reports from these different committees regarding the condition of the buildings. I don't think a doctor is a capable man to go around and inspect all of the buildings. In the first place, he has not the time, and of course he could not do himself justice.

We are very prone to stick to our own ideas, and if we had an expert inspector appointed by the State Board of Health who could control builders' ideas and thereby not let them defraud the public, we would be doing the contractor, the public and the State Board of Health a great service.

THE SANITARY REGULATION OF BARBER SHOPS.

By E. M. Brown.

While this is not a subject as trite in its agitation as many others upon the program, it still is one not altogether fresh and new before the public. Few are the male members of our profession who have not experienced a pang of anxiety as to his personal safety from the contraction of some loathsome disease while under the otherwise restful manipulations of a skilled barber. The medical profession to-day is making gigantic strides in cleanly, hygienic regulations in all of its departments of work, and the laity are fast appreciating its worth.

The agitation of my subject to-day is a public demand, which is properly receiving satisfaction through the medium of the medical and literary press, city and state boards of health, and state legislatures, and it is as much for the interest of the barber that his craft should be again elevated to the

dignity of a profession, as it was once so looked upon and called, as it is for his patrons, and the progressive sanitarium.

The vocation of a barber is co-existent with the beginning of the advancement of civilization. In the book of Ezekiel, 594 B. C., the barber's razor is mentioned; and in the early part of the Christian era the barber did much of the surgical work that was done at that day. And not until somewhere about the middle of the seventeenth century, in France, under Louis XIV., were the barber-chi-rurgeon, as they were called, or barber surgeons, separated from the perruquiers or hair dressers proper and incorporated as a distinct body. In England, in 1461, under Edward IV., barber surgeons first received incorporation. Under Henry VIII., there was a law enacted whereby the barber should confine himself to the minor surgical operations of blood letting and extracting teeth, while the surgeon of that day was prohibited from barbery or shaving.

The barber's sign consisted of a striped pole from which was suspended or hung a vessel, symbols the use of which are, in part at least, preserved to the present day. The spiral red and white stripes around the pole are said to symbolize the winding of a ribbon round the arm previous to blood letting.

In 1745, during the reign of George II., this connection of barber and surgeon was dissolved by an act, the preamble of which affirms that the trade of a barber is "foreign to and independent of the practice of surgery." And from that day until the present the professional dignity of the barber and his shop have greatly deteriorated. I think the barber requires and will be grateful for the strong arm of assistance from the medical profession to start him up again in his scale of existence.

Some states have already taken advanced and positive action in this direction, and Vermont, who boasts of a Health Officers' School, first to organize, and second to none of her sister states, should not be deficient in this sanitary reform.

There cannot be a question of doubt but that parasitic diseases of the skin and scalp can be propagated by the hands and instruments of the barber, and not only this, but specific and contagious diseases as well.

Few practitioners of experience who cannot call to mind cases of tinea, scycosis, tinea favosa, tinea circinata, tinea tonsurans and scabies, the origin of which could be traced to a barber shop, manned by a dirty and careless barber. And I doubt not that there are those present who have seen cases of syphilis, and it may be leprosy, traced to the same source of infection. Not long since, I read in a medical journal a report made to the Cleveland Medical Society of a case of syphilis which was said to have been contracted in a barber shop by the use of alum which had formerly been used on a syphilitic customer. The barbers' business would be bettered, and the sanitary conditions of our state improved, if there were enacted rules and regulations that would make these things less possible. Few states and many cities have and are enacting such laws.

In a paper read at the thirteenth annual meeting of the state and local boards of health of Ohio, held in Columbus January 29, 30, 1903, Dr. W. E.

Hart, health officer of Elyria, his subject being, "The Regulation of Barber Shops," says: "Satisfied, then, of the existing contagion in barbers' shops, what are the remedies? In brief, the whole subject can be summed up in one word, Cleanliness."

"In the accomplishment of this end, we must, first, educate the barber; second, protect the barber by suitable legislation; third, agitate and enforce the rules and regulations recommended by the different boards of health."

At this time, after the reading and full discussion of Dr. Hart's paper, the following motion was present and carried: *"Moved,* That this subject be presented to the Association of Barbers, if there is one in the state, looking toward proper legislation and licensing of barbers, as is done with undertakers and others."

In Missouri there is a state board of examiners for barbers, who have formulated the following rules: The barber shop must be scrubbed with hot water and lye every night. The razors, clippers and scissors dipped in a ten per cent solution of formaldehyde after each use, and the hands of the barber cleansed. Sponges and powder puffs are forbidden, and special disinfection is ordered after operating on any person who has any eruption of the face or scalp.

There was an act passed in 1901, by the Michigan State Legislature, entitled, "An act to provide for the examination and licensing of barbers, and to regulate the management of a barber's shop." This act created a board of commissioners, appointed by the governor, consisting of three members, all of whom shall be practical barbers, and actually engaged in the business. This commission were to hold state examinations, and any one practicing as a barber, in the state of Michigan, must hold a certificate of registration from this board.

Section 10 of this act provides that every barber shall sterilize all tools and utensils used by him in the work of a barber, according to approved methods, and all directions or orders of said board, concerning the proper method of sterilizing tools and utensils, shall be faithfully obeyed by every barber. No proprietor or proprietors of any barber shop in this state shall employ any person as a barber or apprentice who has not a proper certificate and registration under this act.

Sections 11 and 12 provide that the certificate with sanitary regulations and rules governing barber shops shall be posted in a conspicuous place in every barber shop in the state; and also provide that the proprietor or proprietors of any barber shop in this state shall be responsible for the sanitation of his, her, or their barber shops, and the sterilization of all barber tools and utensils, razors, shears, clippers, brushes, combs, shaving cups, and towels used in said barber shop, either by themselves or any of their employees. Also provides that the board may revoke the certificate, and right to practice, upon proof that the holder has become and is afflicted with any infectious disease, or who shall use intoxicating liquors to excess. This act, which in my opinion is one of the very best in force in any state in the Union, was approved June 6, 1901.

The board of health of Boston in September, 1900, adopted the following resolutions, to be posted in all the barber shops in the city:—

"The place of business, together with all furniture, shall be kept at all times in a cleanly condition. Mugs, shaving brushes and razors shall be sterilized by immersion in boiling water, after every use thereof. A separate clean towel shall be used for each person. Alum or other material used to stop the flow of blood shall be so used only in powder form, and applied on a towel. The use of powder puffs is prohibited. The use of sponges is prohibited. The barber shall clean his hands thoroughly immediately after serving every customer. No person shall be allowed to use any barber shop as a dormitory. Every barber shop shall be provided with running hot and cold water."

Also in December, 1902, the department of health at a regular meeting held in the city of Minneapolis, Minnesota, adopted rules for the regulation of barber shops and barber colleges. In these rules, thirteen in number, hot and cold water is demanded, and all implements sterilized with either a 40 per cent solution of formaldehyde or a 70 per cent solution of alcohol. All use of powder puffs and sponges is prohibited. All linen and towels shall be sterilized by boiling. And the place of business open at all times to the inspection of the officers of the department of health.

There are other cities and states in the Union which might be cited as doing effective work in this line, but I have spoken of sufficient to prove the present importance of my subject. I am not a believer in a multiplicity of state commissions, and do not think a barbers' commission is required or called for at the present time in Vermont, but I do think there should be some power vested with our State Board of Health, through legislative enactment, which would require them to formulate rules and regulations to be posted in every barber shop in the state, and that the barber be held strictly responsible for careless and uncleanly work, and his place of business open at all times to inspection by state and local boards of health.

Discussion by Mr. E. B. Moore, Rutland, Vt.

Probably a few have rather come to the conclusion that barber-shop regulations are foolish customs and do not amount to much, but I have discovered that it is a very important question. We have a veterinary who is suffering from what some of the barbers call barbers itch; it has been handed to him through the instruments used by the barber. A year ago we had quite a few suffering from this disease. We had one man in particular who suffered from this; his face was entirely covered, and it extended down to his neck. Such a thing should not happen. In consequence, our board issued a few cards emphasizing the laws adopted by the board of health of the city of Boston. These rules included the cleaning of the hands, but I do not think that is feasible, as continual washing of the hands renders them hard. I advocated the sterilization of mugs, and most of the barber shops have adopted that; also sterilization of razors by formaldehyde. They

object to that for the reason that formaldehyde has a tendency to injure the razor. When a person comes into a barber shop and has no ulceration or face rash, they use a separate cup from that used for the one who has such blemishes. These rules were published and were supposed to be hung up in every shop. A week ago I visited the shops and asked each barber for his objections to them, and everyone agreed they were all right. There was only one shop where they were not hung up, and that was the dirtiest shop in Rutland. It was greasy, and the walls were dirty, and the barber's hands were filthy. Boiling of towels and sterilization of brushes should be compulsory. There are many barbers so diseased that they should not operate. Then there are others suffering from catarrh to such a degree that they are a nuisance, and it seems to be their choice to get right down and breathe in your face. I am very much interested in the paper, and believe in everything that has been said upon the subject. I shall visit these shops and see that these laws are obeyed by all.

WHAT RECORDS SHALL THE HEALTH OFFICER KEEP, AND HOW?

BY DR. F. E. CLARK, HEALTH OFFICER, BURLINGTON.

I was prompted by a suggestion, or a request, from our president, after he had examined a record book that I had arranged for my own convenience as health officer, to prepare a paper on this subject, for presentation to this School.

When I assumed the duties of health officer of our city I was somewhat surprised to find that there was no regular or systematic method of preserving the records of this office; I was still further surprised to find that none were suggested by the State Board. Upon investigating as to the methods of preserving the records of this office in other large cities or towns, I found that the duties of the departments of public health or safety were so numerous, and divided into so many special departments, that no one individual was responsible for the whole work, and therefore no book was arranged for such a multiciplicity of records. Each special department had its own record to keep, and the books were arranged for that department.

Not having found just what would meet our wants here I had to arrange a book for our records. I have the same here on exhibition, and shall be pleased to have you examine it. This book you will observe is arranged from the standpoint that a health officer is not only a health officer, but a plumbing inspector, a milk inspector, a water and ice inspector, an inspector of nuisances, a sanitary inspector, a lawyer, and a coroner. You will observe that in this state the health officer has not only the duties prescribed by the statute to perform, but also numerous special duties put upon him by

the local board of health. I have no doubt it is the same in other towns of our state as it is in this city, so far as this multiplicity of duties is concerned.

Assuming that the health officer is an important individual in any community, and from what we have seen of the duties he is expected to perform, is not his work of much more value to such a community by a careful and systematic recording of every duty performed? Are not his reports to the State Board of Health and the United States Marine Service of much more value and more accurate? Is it not also of inestimable value to such an officer to be able to answer any question, at a moment's notice, pertaining to the sanitary or mortuary condition of his town or city? He will also the more fully realize the advantages of such a system when he comes to make his weekly, monthly, quarterly or annual reports.

If there is any officer in a community who should be systematic and painstaking in the discharge of his duties it most certainly should be the secretary of the local board of health. One of the first esentials of this office, in my mind, is system, not so much because it helps a man to be more correct, but that it helps to prevent the same mistakes being made twice. The careful recording of every duty performed and a tabulated statement made in our annual reports to the cities and towns in which we live, would have a very salutary effect on the community, showing that we are doing, and have done, something besides draw our salary.

In analyzing the first part of the subject of this paper, I wish to accentuate the importance of carefully recording every duty performed. For this purpose it has been my custom to carry a small pocket note book in which to make memoranda at any time or place that I am called on to act officially.

This is a book of general memorandum, and the same serves only to refresh one's memory when making the final record in a manner hereafter described.

The records of this office can be conveniently classified under two heads, viz., Sanitary and Mortuary. By far the greater part of our work is along the line of sanitary inspection. The mortuary records are not so varied, and therefore are more easily kept.

In arranging this book, to which I call your attention, it was my purpose to make it for both sanitary and mortuary records. I therefore devote the first half to sanitary records, and the last half to mortuary. A whole page for each month of the above-named records is provided. The page for sanitary records is again subdivided into weeks and days. You will therefore observe that a day's, or a week's, or a month's record can be seen at a glance. This was suggested by the fact that we as health officers are expected to make a weekly report as to the sanitary condition of our town or city to the State Board of Health, and to the United States Marine Hospital.

The heading of the page is "Sanitary Records." The first space is for the week ending on such or such a date. Below this is the day of the week by initial, and next below is the day of the month. At the left end of the page

there is a wide margin for the names of the various contagious diseases, the records of nuisances and inspections, of bodies examined or autopsied, reports to the State Board and Marine Service, and fumigation. There is a column for totals at the end of each week, and a line for grand totals at the bottom of the page. At the right is a division by wards, so that the records of contagious diseases and nuisances, and the sanitary conditions may be kept by wards. This you will see is of great help in determining the sanitary and unsanitary parts of a town or city. At the extreme right is a space for remarks. There are also blank lines for additional data on the left margin.

The mortuary record is kept by itself in the last half of the book. In the first space under the title of the page can be found the estimated population, the annual death rate for previous years, and the annual death rate based upon the mortality for that month. Below this is the usual arrangement for recording the color, sex, nativity, and age. At the left is a marginal space for the causes of death. At the right the deaths are recorded by wards, and at the extreme right there is a wide margin for remarks. There is also a line at the bottom of the page for the grand total.

I am aware that a careful recording of mortuary records of many towns in our state is not required, from the fact that the health officer does not have to include this in his annual report. In towns and cities where it is required, and where a large exchange list exists with other boards of health, it is important, and much to the advantage of the health officer to make a record from the death certificates received by him in a tabulated, convenient form, from which he can make his report. If this is not done at the time of receiving the death certificates it will be necessary for him to call on the town or city clerk for such certificates in order that he may get the facts relating to mortality of his town. This, you will see, is a cumbersome task, and could have been avoided if he had taken such data as he requires at the time the certificates were first filed.

The records of burial, cremation or removal permits are kept on the stub in a book prescribed by the statute; such record does not enter into a weekly, monthly, or annual report, therefore it is not necessary to include this in the mortuary record kept by the health officer.

The data of official duties performed along the lines of sanitary matters are first recorded in a small pocket note book, to which I have already called your attention. At the convenience of the health officer, either in the evening or the first thing in the morning, these facts are drawn off from this small book and entered in the permanent book, being arranged under their respective titles as indicated on the blank pages for sanitary record which I have passed around.

As these records are of vital importance and interest to the community to which they relate, a system of recording all of the facts and data, which shall lead to a greater accuracy in preserving them, to a clearer understanding of them, and to a greater convenience in readily obtaining any certain facts desired contained in them, is of very great importance.

I may not have evolved the ideal plan of keeping these records, nor do I present the same as a model one, but hope that my suggestions may serve to turn the minds of those interested to the very great importance, both to the health officer and the community, of keeping some such record, arranged in convenient form.

Discussion by Dr. H. A. Elliott, Health Officer, Barnet, Vt.

I am very much pleased with Professor Clark's paper regarding what records the health officer shall keep. Having known Professor Clark longer than any man in Burlington, I can readily understand what records he has been in the habit of keeping. He has rendered the State Board of Health a service which is of great value in establishing a system, which I think they will profit by. I think that similar books will be made up and sent to each health officer in the state. I cannot add to this valuable paper anything, but I wish to speak of a few of the more important points and emphasize them a little. In regard to methods of disinfection, I will say that I think it is a great thing to keep a record of all disinfecting done; then, in after years, if this same disease occurs, you may be sure your disinfecting was inadequate. We, as health officers, should all keep a record of every house, hospital, or building which we disinfect.

Regarding tuberculosis, I feel that the matter has been taken from the local health officer, and he has been ignored. The law of the last legislature has placed it in the hands of the State Board who, of course, know in a general way, yet not in a local way, the number of tuberculosis patients. I think there is something which may be looked into there. Not long ago the director of the Laboratory sent me cards to fill out. These cases dated back a few years. I had no record of them, consequently I was of little service to the director, as I could not recall to mind the patients. That shows conclusively that we need to keep a record of such cases. I will close by saying that there is one record which Professor Clark has omitted. It probably is the only one I have ever kept, and I shall probably keep a closer record in the future; it is a record of fees.

Discussion by Dr. E. J. Fish, South Royalton, Vt.

What the last speaker said prompts me to make the remark regarding the matter of reporting cases of tuberculosis to the State Board of Health as required by law; the idea is not to ignore, nor to take out of the hands of the local health officer, any duty which he should perform, but simply that the State Board of Health may be more fully informed as to the prevalence of the disease in the state, and we hope that a sanitarium may be established; that is the purpose for which we are asked to report all tuberculosis cases to Dr. Holton. I was one of the men who had to do with the passing of that law; hence I am prompted to say this.

A NEW PATHOGENIC THROAT ORGANISM.

By B. H. Stone, A. B., M. D., Bacteriologist Vermont State Board of Health, Instructor in Bacteriology, University of Vermont.

The past winter, 1903-04, has been characterized by a more or less general appearance throughout this state of cases of an acute inflammatory condition of the throat accompanied by a severe but not fatal toxæmia, lasting from twenty-four to forty-eight hours and then subsiding. The cases are usually ushered in with chilliness, pain in head and limbs, and a coryza, often accompanied with an unusual amount of sneezing. In nearly all of these cases, the tonsils have been more or less swollen, the soft palate and uvula œdematous, and in many there has been a distinct membrane, white in color and very tenacious.

Of eighty-one of these cases which have been studied bacteriologically, forty-four have shown a membrane, but this percentage is probably too high, for the reason that the throats of most of these cases were cultured for suspected diphtheria. Of the cases which have been under personal observation the percentage of membranes has been much lower.

The toxic symptoms subsiding in two days leave in most cases an irritable condition of the mucous membrane, which persists for some time, and in some instances the acute symptoms have been followed by great weakness. The attacks are not, as far as can be noticed at present, confined to any particular age, affecting both old and young.

These cases have been variously diagnosed diphtheria, lagrippe, and simple cold, accordingly as the symptoms have been of varying severity and the cases with or without false membrane production.

That they are not cases of true lagrippe is proven by the fact that the period of toxæmia is much shorter, and that none of them show the presence of Pfeiffer's bacillus.

That they are not cases of diphtheria is clear from the entire absence of any organism resembling the true diphtheria bacillus in the false membrane.

The remarkable fact about these cases has been the severe toxæmia coming on suddenly and lasting only a short time, and the universal appearance in the throat of a peculiar diplococcus.

The organism was first noticed by the writer during the winter previous to this one, in the routine examination of cultures from suspected diphtheria throats. It first gave rise to some confusion, owing to its resemblance to certain very short granular forms of the diphtheria bacillus. When first noted it was confined to the cultures received from a certain locality.

The following case histories, for which I am indebted to Dr. C. H. Beecher, are fairly characteristic.

Case 1. Student: When first seen complained of feeling chilly, slight pain in limbs, back and head, and some nasal discharge, and considerable soreness of the throat. He had felt chilly for the past twenty-four hours, but had had no definite chill. The pain in limbs, back and head had appeared in

the last few hours, as had the nasal discharge, which was accompanied by excessive sneezing. The throat had felt dry, and gave some pain on swallowing. Temperature 102 and pulse 110. On examination the mucous membrane in throat, especially over the pillars of the fauces, tonsils and uvula, was of dusky red, considerably darker than the surrounding membrane, and appeared œdematous or gelatinous. This condition was especially noticeable on the uvula. The inflammatory area was coated with a tenacious whitish mucous. Cultures made at this time showed the presence of a peculiar diplococcus in almost pure culture. The temperature, chilliness and the pain only lasted two or three days, gradually disappearing; but the soreness of the throat and the depression, which was considerable, lasted about a week. Repeated cultures of the throat showed the same organism as above.

Case 2. Miss C.: Came into the office complaining only of feeling mean (weakness and muscular pain), and of a sore throat. On examination, the throat was congested and œdematous. There were six or eight whitish patches of adherent exudate on the tonsils and pharynx. Bacteriological examination of the throat secretions showed the same diplococcus as was found in Case 1. Temperature at this time was 103, pulse 120. That night the patient slept poorly, and the following day the throat was more painful and more œdematous, but the patches of exudate were practically the same size as on the previous examination. Temperature and pulse as on the preceding day. The throat was again cultured with the same results as before. After the second day the symptoms gradually improved. The patches disappeared, and the patient felt well enough to resume work on the fifth day from the first examination. Cultures taken then still showed a pure culture of the diplococcus.

In addition to many cases of this sort which are apparently the typical manifestations of the pathogenic effect of the diplococcus mentioned, the same organism has been met with in several cases of typical follicular tonsilitis, and in the throats of three cases of scarlet fever, and in many cases of irritable throats following diphtheria. In one case of purulent meningitis following middle ear disease, the diplococcus was found in the meningeal pus.

The organism occurs in the secretions and exudations of the inflamed membrane. It is diplococcus with its adjacent sides slightly flattened. When stained by Leoffler's stain, one or both of nearly every pair has distinct metachromatic granules which stain very intensely. When stained with fuchsin the granule does not show. One of the pair is often smaller than the other. In preparations made from bouillon or blood serum cultures, the pairs are clumped in irregular bunches, apparently held together by some gelatinous material which does not stain. They vary from one-half to one microm in diameter, and the flattening on adjacent sides is sufficient to render the combined diameter of the pair but little greater than the opposite diameter of the single member.

They stain readily by Leoffler's and fuchsin and by Gram's method, although the clear space between the members of the pair and the polar

granules are best seen with the first stain. There are no flagella, spores or demonstrable capsule. Almost no growth occurs in gelatin, and there is no liquifaction.

On an agar plate grown at 37° C. for twenty-four hours, round regular colonies appear. They are white raised (pulvinate) and very tenacious, so that it is impossible to take up any of the colony without taking it all. They grow very little larger than the head of a shawl pin.

On agar streak cultures the character of the growth is similar to that on plates. The white colonies are first discrete, regular in outline and pulvinate, but gradually they coalesce along the line of the needle tract and the result is a more or less continuous nodular growth. Growth is never luxuriant, however, and does not spread laterally far from the needle tract.

On blood serum, growth is quite luxuriant, appearing first as moist, glistening, white colonies, which soon coalesce, forming a viscid, extremely tenacious skin over the whole surface of the medium. The medium is not liquified.

On potato, growth is similar to that on serum, only less luxuriant. The potato is not discolored. In bouillon its growth forms a white, stringy sediment, sticking tightly to the bottom of the tube. There may be a slight general turbidity. In litmus agar, it produces no change in color. It produces nitrites in nitrate broth, does not form indol, or gas, or acid in glucose, lactose, or saccharose solution.

For all of these growths it requires oxygen and a temperature near 37° C. The thermal death point is between 60 and 70.

Animal inoculations were made with the following results:—

Animal No. 1. An intra-peritoneal inoculation of a young guinea pig proved fatal to the animal in five days. A seventy-two hour bouillon culture was used. The animal showed few symptoms of infection until the fifth day, when symptoms of profound toxæmia commenced and increased very rapidly, resulting in death in a few hours. An autopsy showed a slight subcutaneous œdema with a collection of white, viscid, tenacious pus around the peritoneal wound. Peritoneal cavity contained much semi-solid tenacious exudate, which microscopically showed fibrin, pus cells and diplococci. The mesenteric glands were all enlarged and showed the presence of the same organism. Blood serum cultures made from the peritoneal exudate resulted in a growth of a pure culture of the diplococcus.

Animal No. 2. Rabbit: Inoculated intra-venously with an old bouillon culture. This animal died in convulsions within twelve hours of inoculation. An autopsy showed a general congestion of the viscera, especially noticeable in the kidneys and liver. The bladder was filled with dark-colored, apparently bloody, fluid. Smears of liver and splenic pulp were negative. Five cultures taken from heart's blood all showed pure growth of the diplococcus.

Animal No. 3. Guinea pig inoculated with the filtrate after passing an old seven-day bouillon culture through a Berkfield filter. This animal on the second day showed an irregular pulse, and on the next day was unable to walk, staggering, and finally falling over. Spasms developed, and the

animal died in forty-eight hours from the time of inoculation, presumably as a result of the soluble poison produced by the organism in its growth in the bouillon.

Animal No. 4. Guinea pig inoculated subcutaneously with a young bouillon culture failed to respond.

Animal No. 5. A guinea pig was inoculated by slightly abrading the mucuous membrane of its lips and rubbing in a young culture. This experiment was negative.

Other animal experiments have been confirmatory of the results obtained from the above-described inoculations, showing that the organism is variably pathogenic for laboratory animals.

The fact that the poison produced by this diplococcus in its growth is soluble, and that an attempt to isolate ptomaines by Breiger's method was negative, renders it fairly certain that the poison is a true toxin.

The writer is thoroughly convinced that this organism stands as the etiological factor in the above-described throat cases, even though efforts to reproduce its peculiar lesions on the mucous membrane of laboratory animals have been so far unsuccessful.

First. Because it has been found constantly present in these cases in almost pure cultures and isolated, while no other organisms are constantly found.

Second. Because it is not generally found in healthy throats. An examination of over two hundred cultures made from healthy throats have failed to show this diplococcus in hardly any case where it could not be explained as persisting after an acute attack.

Third. Because it is toxic for laboratory animals, producing on serous membrane an exudate analogous to that produced in the throat from which exudate it has been recovered in pure culture.

Fourth. Because it produces a soluble toxin sufficiently virulent to kill animals.

Fifth. Because its blood serum growth has a peculiar viscid character, suggesting the extreme viscidness of its exudate in the throat.

THE PURE FOOD QUESTION.

By C. P. Moat, Chemist, State Board of Health.

One of the leading questions of the day in sanitary lines is the adulteration of foods and drugs. The purpose of this paper is to give a brief history of adulteration; touch on some of the laws of the United States, states, and cities relating to this subject; their enforcement; work done in other states; and, what we might do in this line here in Vermont.

There are several notices of ancient sophistications practised by the Greek and Roman traders, but the most interesting and copious material for the history of adulteration comes from the middle ages.

The mixing or, rather, alloying of gold and silver with the baser metals may be justly considered of the nature of adulteration, and has prevailed contemporaneously with the art of coinage. Pliny mentions frauds practiced by bakers in adding to the bread some white earthy substance. He also writes of other adulterations. In Athens it was necessary to have a special inspector appointed to detect and stop the adulteration of wine. Both Greek and Roman history hand down accounts of wine being tampered with. In the history of England, France and Germany, or in fact Europe from the eleventh century on, the bakers, vinters, brewers, and "pepperers" were most frequently accused of corrupt practices. But morality in general was low at that period, and we must not judge them too harshly.

Adulteration has two aspects, financial or economic, and physiological or sanitary, and this is recognized in most of the recent laws defining adulteration. With a few important exceptions, the condition of food sold is an economic rather than a sanitary affair. Nevertheless, there are reasons why the control of these matters should be exercised by the sanitary authorities. While many adulterants are harmless, some are not so, and that reason and the fact that the line cannot always be sharply drawn between the harmless and the harmful would logically give this control to the health department.

Great differences exist in food laws and their administration. The control of food substances as regards both legislation and execution is sometimes national, sometimes state, and sometimes municipal.

The federal government by virtue of its authority and control of interstate and foreign commerce has legislated concerning the wholesomeness and purity of food supplies, and has a large force of inspectors constantly at work. The chief field covered by these federal inspectors has been the inspection of cattle intended for slaughter, and of the various products sent out from the slaughter houses. This line of work will be broadened by the provisions of the Hepburn Pure Food Bill, which will be mentioned later in this paper.

Much of the legislation concerning adulteration is state work, and the execution of these laws is vested in state officers. The execution of milk laws is more often in hands of the local boards of health.

Laws relating to the use of foods from diseased animals are usually state laws.

The earliest laws regarding food were of a very general character, and many of the states retain these on their statute books to-day. Some of these general laws forbid the sale of unwholesome food, and also cover the inspection of markets, bakeries, etc. Misbranding is forbidden in some of these general laws.

FEDERAL LAWS RELATING TO ADULTERATION AND SUBSTITUTION.

Up to 1902 all the federal laws relating to food were intended primarily as revenue measures, and forbid importations of adulterated foods, drugs, or liquors. The new pure food bill (Hepburn), which was unfortunately not passed by Congress this year, extends federal inspection to all food and drug products. The bill in outline charges the Bureau of Chemistry of the Department of Agriculture with the inspection of food and drug products. Interstate and foreign commerce in articles of food or drugs which are misbranded or adulterated within the meaning of the act is forbidden. Articles which are suspected of adulteration are to be examined from time to time by the Bureau of Chemistry, such articles to be taken in original and unbroken packages in any state other than where produced. Foods and drugs are defined in the bill, also what constitutes adulteration and misbranding under the act. The Bureau of Chemistry is to provide standards for the act.

STATE LAWS.

Some kind of state legislation on the subject of adulteration of food is found in the laws of every state. In many of the states these laws are very general and vague, but these are being modified as time goes on.

Some of the legislation is in the form of general prohibitions, simply forbidding the sale of "adulterated provisions, whether for food or drink." Ohio and Rhode Island have laws of this kind, and those of Louisiana are similar.

Next to this are those with more explicit forms, as in Michigan, Colorado, Idaho, Indiana, Kansas, Maryland, and Montana. Somewhat similar are those in Georgia, Maine, Missouri, South Carolina, Vermont, Virginia, and West Virginia.

General provisions are also found in states in which the laws are more extensive and explicit.

In those states in which the subject has received the most attention, and where active measures are taken to prevent and punish adulteration, the laws usually define with utmost exactness what substances are not to be adulterated, and in what adulteration consists.

Massachusetts since 1882 has waged active warfare against adulteration, and her statutes in this respect may be given as a good example.

Other states with similar laws sometimes closely following Massachusetts

are California, Connecticut, District of Columbia, Illinois, Indiana, Kansas, Kentucky, Michigan, Mississippi, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Arkansas, Pennsylvania, South Dakota, Tennessee, and Wisconsin.

In the statutes of the many states, various kinds of food are specified, viz., drugs and medicines, liquors and wines, vinegar, molasses, sugar and honey, flour and bread, baking powders containing alum, coloring matter, poisonous ingredients, candy, fruit jelly, coffee, olive oil, catsup, and lard.

EXECUTION OF FOOD LAWS.

Food laws may be executed by the federal government and by the states and municipalities, as the laws are made by all these, but most laws are of little value unless they can be enforced, and this is especially true of food laws. The whole value of these laws depends on the efficiency of their execution. Beside statutes and ordinances, there must be inspectors and analysts. Even with the latter alone, the mere exposure and publication of frauds may be of some moral effect, even if the laws do not reach the offender.

Federal inspection by the Treasury Department is made of importations of adulterated food, and by the Department of Agriculture of the interstate commerce in meat and slaughter-house products.

The control of adulterations and substitutions, which mainly concerns us in this paper, is usually a state charge, and is either under control of the state board of health, or the dairy or food commission. The first-mentioned board is the proper one in my opinion, especially where a state laboratory for sanitary work is established, although the dairy and agricultural commissioners are best fitted for the inspection of dairy products. Various provisions are made in the different states for laboratory work, the work being carried on at state laboratories, experiment stations, colleges, etc.

Much local inspection is done in the larger cities of this country, many of which have their city laboratories, inspectors, etc.

Much more has been done in regulating the sale of adulterated dairy products than of any other article of food. Laws relating to butter and cheese are found in all but five of the states and territories, these being Alaska, Mississippi, New Mexico, Texas, and Wyoming. The greater part of these laws as well as the ordinances in force in many of the cities are concerned with the adulteration of milk by dilution or by the addition of preservatives, and until lately very little has been done about having clean milk. Some of the larger cities now consider this latter and very important point.

The following table will give an idea of the kind of food laws, exclusive of dairy laws, in the United States, and their manner of enforcement:—

STATES.	LAWS.	POWER OF ENFORCEMENT.
Alabama	General Law	None
Alaska	"	"
Arizona	"	"
Arkansas	"	"
California	Modern food and drug law	"
Colorado	"	"
Connecticut	"	Dairy Commission
Delaware	General law	None
District of Columbia	Modern food and drug law	Health Officer
Florida	General law	None
Georgia	"	"
Hawaii	Modern food and drug law	Board of Health
Idaho	General law	None
Illinois	Modern food and drug law	Food Commissioner
Indiana	"	State Board of Health
Iowa	General law	None
Kansas	Modern food and drug law	"
Kentucky	"	Director State Experiment Station
Louisiana	General law	State Board of Health
Maine	"	None
Maryland	"	State Board of Health
Massachusetts	Modern food and drug law	State Board of Health and Dairy Bureau of Board of Agriculture
Michigan	"	State Dairy and Food Commissioner
Minnesota	"	State Dairy and Food Commissioner
Mississippi	"	None
Missouri	General law	"
Montana	"	"
Nebraska	Modern food and drug law	Deputy Food Commissioner
Nevada	General laws	None
New Hampshire	Modern food and drug law	State Board of Health
New Jersey	"	"
New Mexico	General	None
New York	Modern food and drug law	State Board of Health
North Carolina	"	Board of Agriculture
North Dakota	"	Commissioner of Agriculture
Ohio	"	Dairy and Food Commissioner
Oklahoma	General laws	None
Oregon	Modern food and drug law	Dairy and Food Commissioner
Pennsylvania	"	"
Philippines	General law	Board of Health
Porto Rico	Modern food and drug law	Superior Board of Health
Rhode Island	General law	None
South Carolina	Modern food and drug law	State Board of Health
South Dakota	"	Food and Dairy Commissioner
Tennessee	"	State Board of Health
Utah	General laws	Food and Dairy Commissioner
Vermont	"	None
Virginia	Modern food and drug law	State Board of Agriculture
Washington	"	State Dairy Commissioner
West Virginia	General law	None
Wisconsin	Modern food and drug law	Dairy and Food Commissioner
Wyoming	General	None

COMMENT ON ABOVE TABLE.

Connecticut.—The State Experiment Station is authorized to establish standards of purity, quality, or strength, when such standards are not specified by law. These laws have never been enforced.

Indiana.—The State Board of Health may make rules and ordinances establishing standards and prescribing adulterations. This power has been sustained by the Supreme Court, thus giving the food law an elasticity which does not belong to like laws in other states.

South Carolina.—Laws not enforced.

Tennessee.—Laws not enforced. No appropriation.

Utah.—Laws not enforced. No appropriation.

Washington.—Laws patterned after proposed national food laws.

Having given some idea of what is being done in this line in other states, where do we stand here in Vermont on this question? Our food laws are general, which the following brief outline shows.

General food laws with articles on: Penalty for sale of unwholesome provisions; slaughter of calves; penalty for adding injurious ingredients to foods.

Special articles: Alcoholic beverages; candy; dairy products; flour; lard; maple products and honey.

No provision is made for the enforcement of the above, except that their violation is classed as a misdemeanor and is punishable as such. What can we do to prevent food adulteration in this state? We have only a general food law, with no powers charged with its enforcement. We have no system of inspectors. We have a State Laboratory, where examinations of food products are free to all the people of the state. Why not use it, publish our results, and arouse sentiment on this question that will bring us pure food legislation with power to enforce same, such as our neighbors, Massachusetts and New Hampshire, now have?

Articles most frequently adulterated and misbranded; look these over and consider the question of their use: Canned goods, cocoa, spices, olive oil, lard, shredded codfish, milk, cream of tartar, honey, molasses, vinegar.

Foods containing preservatives: Fancy cheeses, oysters and clams, tomato ketchups, sausage, bottled cider, grape juice, lime juice.

Foods containing coal-tar colors: Jellies, jams, ketchups, lemon extracts, and many drugs not up to United States Pharmacopœia.

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BULLETIN OF THE

VERMONT STATE BOARD OF HEALTH.

The Bulletin is published quarterly by the State Board of Health under the authority of Section 5 of Act No. 90, Legislature of 1900. It will be sent to all Boards of Health. A copy will be sent to any person in the state upon request addressed to the Secretary, Henry D. Holton, Brattleboro.

NEWS ITEMS.

Regulations Adopted Under Authority Given by Section 7, Act 113, Laws of 1902. The State Board of Health of Vermont adopted the following regulations at a meeting held in Burlington, April 14, 1904: Hereafter no city, town, village, community, public institution, or individual, shall empty any sewage into any body of water, or spring, or stream tributary thereto, when such water is used by any city, town, village, public institution, or by any water or ice company, as a source of water or ice supply for domestic use.

HENRY D. HOLTON, Secretary.

Town Clerks. The first six months of 1904 will soon pass, under the law; it will be your duty to forward to this office a report of all marriages, births, and deaths that have occurred in your town during that period. Allow us to suggest that when a certificate of any of the three most important events in the life of a person reaches your office, you immediately enter it upon the abstract sheet, already sent you for that purpose. Then at the close of the semi-annual period your report will be ready to transmit to the secretary. In tabulating these it is exceedingly laborious, requiring considerable time; if a few towns fail to send these returns, the whole work ceases, and averages cannot be made of even a county if one town of that county is missing.

Embalmers. There will be a meeting for the examination of persons desiring to carry on the business of embalming of human bodies, at Burlington at nine o'clock Thursday morning, June 30.

Thursday, June 30, Morning Session, 9.30.

Paper, Some of the Problems, Water Supply, Sewage Disposal in Vermont, by X. H. Goodnough, Engineer Massachusetts State Board of Health.

Discussion, Dr. F. E. Clark, Burlington; Dr. J. H. Hamilton, Richford; Dr. F. S. Hutchinson, Enosburg Falls.

The School of Instruction for Health Officers was established by act of the legislature. All health officers of the state are hereby warned and directed to report in person at Burlington for the purpose of attending the School of Instruction for Health Officers, to be held in the Young Men's Christian Association Hall, entrance on College Street, near Church, opening Monday evening, June 27, closing Thursday noon, June 30.

Remember that attendance upon this School is one of the duties of every health officer, and will be so treated.

Per Order of the State Board of Health.

Henry D. Holton, Secretary.

All railroads of the state will give convention rates to all those attending the School.

A register of the School will be open at the office of the Young Men's Christian Association, where hand baggage and overcoats may be checked at any time. Those who wish board in private families will there find a list of boarding houses.

Every member of a local health board should register immediately on arrival.

The Laboratory of Hygiene, 196 Main Street, will as usual be open at all times to visiting health officials, and all are expected to make free use of the Laboratory rooms.

The School sessions are open to the people of Vermont, and all are invited to participate in the discussions as far as the time will permit. Health officers are expected to utilize the opportunity to get information on any points of practical importance in their work, and all will study brevity in their remarks and questions.